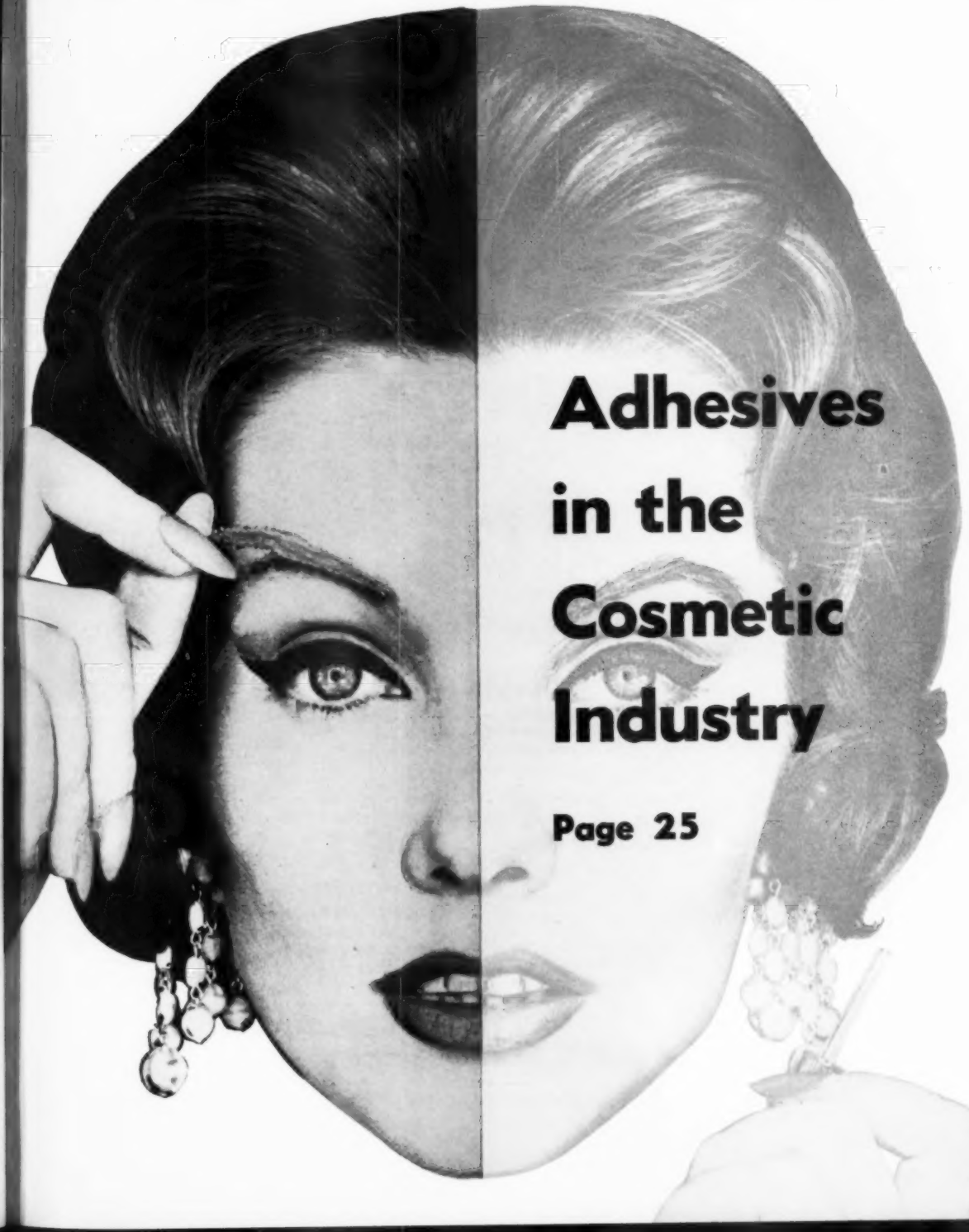
Applied Science

ADHESIVES AGE

MANUFACTURE, APPLICATION, TECHNOLOGY, RESEARCH AND MARKETING

AUGUST, 1959



Adhesives in the Cosmetic Industry

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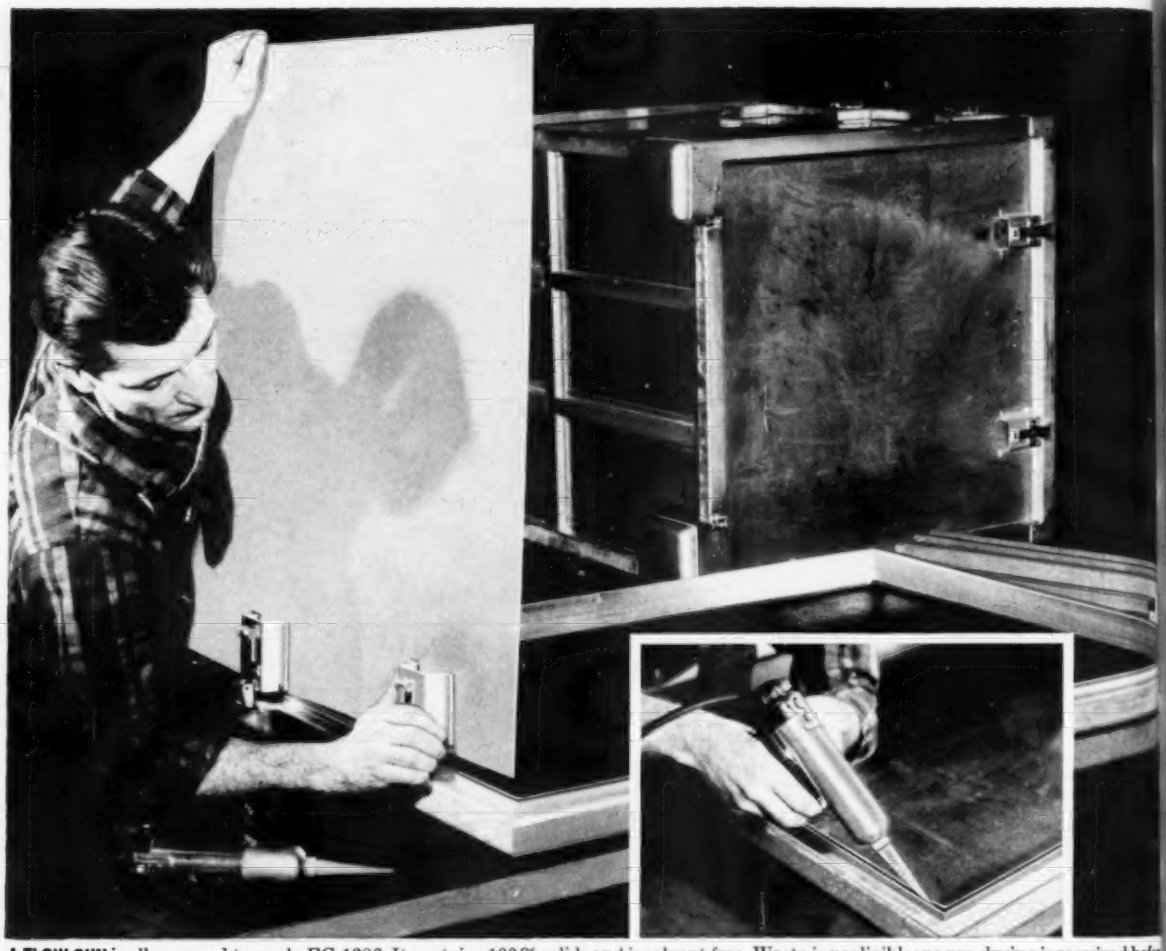
How 3M Adhesives solved this Modular Packaging System problem



A FLOW GUN is all you need to apply EC-1386. It contains 100% solids and is solvent free. Waste is negligible; no pre-drying is required before joining sections. The adhesive bond can be cured to high ultimate strength quickly in an air-circulating oven (one to two minutes at 500°F.

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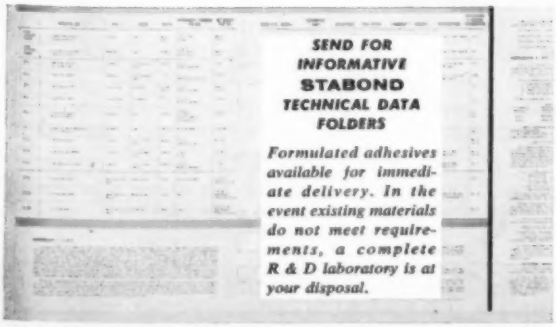

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Have you *tried* Animal Glue? If you have adhesive problems, it's worth looking into. Send for samples but be sure to tell us your problem! There just isn't any such thing as plain Animal Glue! We have Bone Glue, Hide Glue, Chrome Glue, Technical Gelatin and others. We have it in Gel tests of 40 to 500 grams and over. We'll meet your requirements if you'll tell us what they are.

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ADHESIVES AGE

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About the Cover Design

The pretty face on this month's front cover relates to our article on "Adhesives in the Cosmetic Industry" which begins on page 25. Rarely thought of as a consumer of adhesives, the cosmetic industry does represent a major consuming entity with a wide variety of unique and demanding applications. Photo courtesy of Elizabeth Arden.

The opinions expressed by authors and contributors to ADHESIVES AGE are not necessarily those of the editors or publisher. Articles appearing in ADHESIVES AGE may not be reproduced in whole or in part without the express permission of the publisher.

PP PALMERTON PUBLISHING CO., INC.

AUGUST, 1959

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News about R&A SINCE 1913 **Adhesives**

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Two ways to bond rigid 'styrene foams without fear of cell attack

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Those "urethanes", though, are used so many different ways (to themselves, to metal, wood, fabric, grit, etc.) that the "best" formulation will depend not only upon the materials you are working with but upon the bond characteristics you consider most important.

We've over a dozen different formulations that are used to mass-production-bond urethane foams right now. One of these could very well be exactly what you are looking for.

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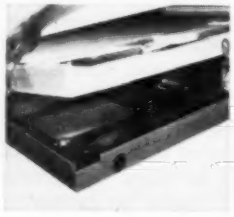

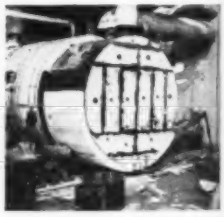

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Either way, they enable you to overcome the key problems involved in bonding these plastic foams to themselves or to metals, wood, cement board, or other materials, since all feature high strength, moisture-resistance; resistance to odor absorption and transmission (essential in refrigerator work), resistance to freezing temperatures; and long-time aging properties in the completed bond.

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You wouldn't suppose heat resistance mattered since the foam won't stand too much, itself. However, there are some installations (mostly military) where a void-filling adhesive must resist "creep" at temperatures up to the foam's softening point . . . and under structural loads, at that! For such applications, most foam manufacturers' literature recommend a 100%-solids epoxy such as BONDMASTER M664 or M688.

For technical data and samples of the rubber-resins or the epoxies tell us about your specific problems.

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EDITORIAL

Committees and Cooperation

Elsewhere in this issue there appears a report on an action taken by the American Society for Testing Materials which attests to the continuing growth of the adhesives industry. ASTM has formed a steering committee for the purpose of discussing the formation of an active group on elastomeric joint sealants for the building industry. The steering committee has now decided that a new and distinct ASTM committee would best serve the industry and its needs. This committee will be known as Committee D-27 on Elastomeric Sealants.

The scope of the committee has been defined as covering the development of test methods, classifications, nomenclature, and performance specifications for elastomeric sealing materials for use by the construction industry for sealing joints. Typical sealants include elastomeric caulking and glazing compounds and preformed gaskets and tapes. There is now a move afoot to form a Polysulfide Subcommittee which will be concerned with the performance specifications developed by the Building Trades Specification Subcommittee, the Rubber and Plastic Adhesive and Sealant Manufacturers Council, and the National Association of Architectural Metal Manufacturers.

Of course, we would first take this occasion to express our wishes for the success of the new committee. We can testify to the degree of interest which exists in sealants—their manufacture and application. In the July issue of this journal, for example, we published an article on the polysulfide sealants. The reaction to this article has been astounding. Requests for copies of the article have come from all over the world and the reprints are running into the thousands.

The action taken by ASTM will serve to amalgamate and codify activities in this important segment of the adhesives industry. It is becoming more and more apparent that sealants are a big business and, as a matter of fact, adhesives are a big business. In months to come we shall see the formation of new technical and business groups concerned with adhesives and their application.

Which brings us to the reiteration of a point we have been making from time to time in these columns: The adhesives industry is a *big* industry. The committees and groups formed for the advancement of the industry are worthy of *your* support. ADHESIVES AGE hopes to do its part in publicizing and promoting the growth of the industry. Each manufacturer, each supplier, each consumer, must do his part, however. He can best do this by lending his support to the various organizations which are now active or in the process of formation. Detailing personnel to attend adhesive group meetings is an investment in the future of the industry.

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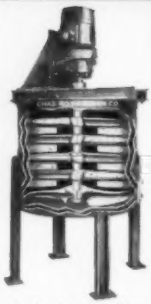
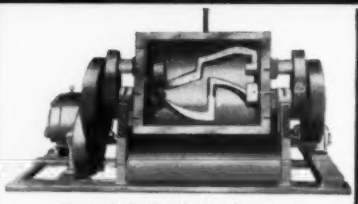
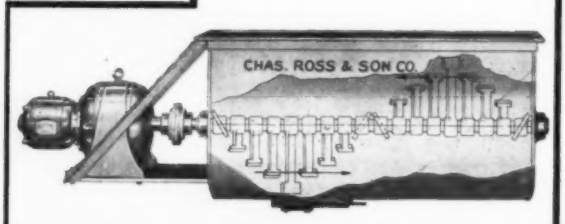


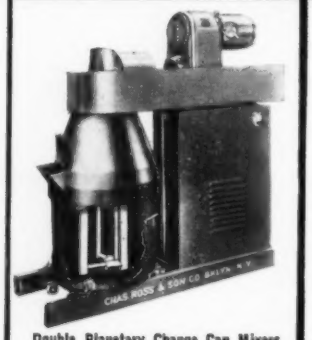
Rubber Cement Mixers
100 - 1000 Gal. sizes



Heavy Duty Double Arm Kneaders
1 pint - 150 Gal. sizes

Horizontal Mixers
100 - 1000 Gal. sizes





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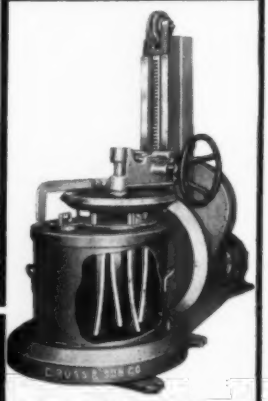

Heavy Duty Change Can Mixers
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CONSULTANT'S CORNER

By Dr. Irving Skeist

High Temperature Adhesives

Dr. S. Orchon, senior engineer in the Coated Abrasives Division of the Carborundum Company, brings my April column up to date with this information on brazing: "In the years past I . . . was successful in brazing metals to non-metals. Work has to be performed, however, in ovens with controlled atmosphere and low dew point (−70°F.) using metal brazes and scouring compounds in the family of metal hydrides. I am not sure if it can be applied as an answer to the particular problem, but in general it is feasible to do so. Personal regards. P.S. Consult the following patents: U.S. 2,782,110; 2,282,106; 2,139,431; 2,351,798."

Readers with additional information on high temperature adhesives for bonding metals to insulation are invited to comment.

The Versatile Vinyls

My July column has drawn a note from Wm. J. Kehoe of Putnam Chemical Corporation, U. S. representatives of Badische Anilin & Soda Fabrik A. G., calling attention to their polyvinyl ethers for adhesives, Oppanol C and the Lutanols. It was impossible to do justice to the vinyls in a single brief column. When space permits, I'll come back to the subject.

Questions and Answers

Question: We are vitally interested in information on new adhesives of both the pressure sensitive and water activated types that can be applied by the silk screen process to decalcomanias. Could you recommend a source whom we may contact for these two types of adhesives?

Answer: To be suitable for silk screening, the adhesives should be of knife-coating viscosity, *i.e.*, upward of 15,000 centipoises. The pressure-sensitive composition should be solvent-based, while the water-activated type will be laid down most easily from aqueous suspension or solution.

One type of water-activatable composition involves dextrin, a vinyl acetate polymer, and a watersoluble synthetic resin. The latter must be compatible with dextrin, as must the protective colloid employed in the polymerization of the vinyl acetate.

Q-108

CONSULTANT'S CORNER

Readers who would like to contribute their own experience with problems similar to those discussed in Dr. Skeist's column are invited to write to ADHESIVES AGE, *101 West 31st Street, New York 1, New York. Please refer to the code number given at the end of each question and answer group.*

Question: Current information is desired for experimental work with adhesives and sealants for continuous exposure to steam and sea water in the 180°-220°F. range for five to twenty years. Other applications may require materials suitable for less severe service in the 300°-500°F. range.

Answer: Epoxy resins are the most likely prospects for both applications. For highest temperature resistance, liquid epoxies should be compounded with aromatic curing agents such as diaminodiphenylsulfone.

No information is available on the twenty-year performance of epoxies; they are too young. Extrapolating from what we do know, however, the prognosis is good. Epoxy compounders should be consulted; many of them have no doubt accumulated accelerated aging data with equipment such as the WeatherOmeter.

Incidentally, the question points up a problem in developing improved materials, particularly for construction. If the user insists upon "the test of time," he cuts himself off from new products that may be far superior to those he is now using.

Q-114

Question: We are led to believe that a soaking of veneers in a phenolic resin for tougher plywood product is being done. Is this phenolic resin of a formaldehyde base?

We hear of impreg and compreg. What is the difference?

In order to secure a waterproof plywood, can any Group I adhesive be used if the veneers contain phenol?

Answer: Phenolic resins do start with formaldehyde, along with chemicals of the phenol family such as phenol itself, cresol, para-tertiary butyl phenol, and resorcinol.

Impreg is veneer impregnated with resin, cured, and then laminated in three or more plies with additional resin. In compreg the veneers again are impregnated with resin, but are assembled and cured as a laminate. Curing is accomplished with heat and pressure.

Phenolic adhesives are preferred for bonding phenolic veneers.

Q-115

Dr. Skeist is associated with Skeist & Schwarz Laboratories, Inc., 89 Lincoln Park, Newark 2, N.J. He is the author of the recently published book, "Epoxy Resins."

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new adhesives

AND ADHESIVE PRODUCTS

Metal-Vinyl Laminate

A colorful, durable, pre-finished basic material for a wide range of consumer products is now possible through bonding a vinyl plastic sheeting to steel, aluminum or magnesium. In production, the pre-finished vinyl plastic sheet is adhesive-bonded to the metal to give a decorative effect while utilizing the structural qualities of the metal. Claimed to be impervious to temperatures up to 200°F., the metal laminate will not chip, crack or craze. Produced under the name Sullvyne-Clad metal laminate, the product is said to have excellent corrosion and abrasion resistance. It can be worked as precisely as metal alone and requires no special dies or drawing compounds. Sullvyne-Clad is produced in a wide range of colors and embossed patterns. It has the same dimensional stability as the base metal of the laminate, withstands tearing up to 460 pounds and has minimum tensile strength of 2,500 psi. *O'Sullivan Rubber Corp.* P-148

Liquid Adhesive Resin

A chemically modified urea-formaldehyde liquid resin adhesive in aqueous dispersion for "gap filling" and craze-resistant glue lines up to 0.02 inches in thickness has been introduced under the trade name, No. 6930 Plyamine. This adhesive is used in gluing applications wherein irregular contact surfaces and/or inadequate pressures do not permit a thin glue line and intimate contact between laminate and gluing surfaces. Gap filling, shrink, craze and moisture resistant, the product allows pressures from contact to 250 psi on all conventional hydraulic, screw-type or hand clamp presses. It may be pressed at temperatures ranging from 70 to 250°F. No. 6930 Plyamine gives a light brown or tan color appropriate to most wood gluing or lamination. *Reichhold Chemicals, Inc.* P-149

FOR MORE INFORMATION on the new products reviewed here, use the Reader's Service Card which appears elsewhere in this issue.

Cycleweld Liquid Iron

An iron-like adhesive and sealer that can be used to repair virtually everything from a broken chair leg to a cracked engine block has been introduced under the name Cycleweld Liquid Iron. The new product is a putty-like synthetic plastic that sets up into a substance like iron a few hours after it is mixed with a clear liquid hardener. After it has hardened, it may be ground, sanded, shaped, filed or drilled in the same manner as iron. The manufacturer states that a bond resulting from the use of the product will retain its strength under heat up to 300°F. and at cold temperatures down to 0°F. Liquid Iron is applied with a putty knife or trowel and will retain its shape and position without running. *Cycleweld Chemical Products Division.* P-150

Self-Adhering Safety Tape

A green self-adhering safety tape is reported to help reduce accidents and save lost man-hours by protecting fingers, hands and forearms against cuts, burns and abrasions. Easy to remove and apply, the tape, called Guard-Tex, leaves no sticky residue or color stain. In glass making, the product is said to be ideal in protecting hands and fingers against burns and cuts. Dispensed in rolls of desired widths, the product conforms neatly to finger contours without bulging or leaving "corners." A special oil resistant tape is also available in a white color. *General Bandages, Inc.* P-151

Tile Setting Adhesive

A new type water-resistant organic tile setting adhesive for thin set installations can be used for bonding ceramic floor or wall tile to any surface—masonry, wallboard or metal. Lion-Bond adhesive is odorless, non-inflammable, cannot stain tile or grout and both tile and tools can be cleaned with water alone. Since no solvent escape time is necessary, grouting can be started as soon as the bond holds the tile in position—usually one hour. *Cambridge Tile Manufacturing Co.* P-152

Curtain Wall Tape

What is said to be a major breakthrough in the construction field has been scored with the development of a synthetic rubber tape, reinforced with nylon fibers, that is now being introduced to curtain wall fabricators. Named U-100 Sealing Tape, the product has had a long trial testing program during which time it has exhibited resistance to oxidation and hardening, virtually permanent flexibility, and excellent adhesion to a variety of surfaces including glass, aluminum and brass. Its ozone and weathering properties have been excellent according to fabricators who have been using the tape for the past year. Laboratory tests have indicated that the product remains flexible at −76°F. It also remains stable at continuous temperatures up to 150°F. and can withstand intermittent readings up to 300°F. without ill effect according to the manufacturer. The tape, which comes in black or grey, is available in a dozen widths from a quarter-inch to three-inches, and in six thicknesses ranging from a thirty-secondth of an inch to three-sixteenths of an inch. *U.S. Rubber Co.* P-153

Heat Sealable Mylar Tape

The development of a rubber coated Mylar tape which will heat seal in the 200°F. temperature range permits its use in many wire and cable applications including service entrance cable. The tape gauges 3 mils (using 1 mil base film). It is coated on one side and may be furnished in any color. The tape is also available in other gauges and constructions. Highly waterproof, the tape is said to have excellent color stability. The coating is said to be more compatible than resin coatings as there is no plasticizer migration. *Peters Manufacturing Co.* P-154

Self-Adhesive Foam Tape

A new, inexpensive polyurethane foam tape coated with a unique high-temperature pressure sensitive adhesive will hold permanently in spite of temperature fluctuations from 0 to 300°F. Both the polyurethane and the adhesive are non-corroding and impervious to moisture, the manufacturer declares. The tape is said to have excellent sound and heat insulating qualities, superior cushioning against shock and vibration and is chemically inert. *Richards, Parents & Murray, Inc.* P-155

Pressure-Sensitive Metallics

Brilliant pressure-sensitive metallics are now finding use in a wide range of products as permanent decorative trim, panels and identification plates. Formed of Mylar backed by a special vinyl to provide body for the over-all material, the new metallics are said to reduce assembly costs on air conditioners, radios, boats, juke boxes and a variety of electrical appliances, display materials, etc. In manufacture, a primer or tie coat is used to join the vinyl with a permanent-gripping adhesive, affording a smooth, bubble-free finish under ultimate bonding. Available in stock or custom materials, the metallics are furnished in a variety of color tones. They are also available in embossing patterns. Weather, stain and abrasion-resistant, the new metallics may be ordered in rolls, strips or sheets. *Avery Label Co.* P-156

Epon X-81 Liquid Resin

Designed for adhesive applications where changes in temperature tend to weaken bonds, Epon X-81 resin can be cured with conventional aliphatic or aromatic polyamines or acid anhydrides. With a viscosity of 750-800 at 25°C. (cps), the product has a Gardner color of 10-11 and an epoxide equivalent of 320-245 grams. Its low liquid stage viscosity makes the resin useful in solventless surface coatings. This also permits deep penetration in electrical system encapsulation. The manufacturer states that in standard stretch or elongation tests at room temperature, a casting of resin doubled its length before breaking. *Shell Chemical Corp.* P-157

White Marble Sealant

Designed specifically for use on white marble and other light-faced stone and masonry joints, Del Synthetic Rubber Compound Special Grey J-31, when used with a special primer, will not stain the most delicately colored marble or stone. The new product "gives" without cracking and stress and strain or normal building movement and will not open due to the expansion and contraction resulting from temperature fluctuations. A paste compound, it may be applied to any surface, hole, crack or joint. It sets up overnight, without shrinking, into a permanent, flexible, solid seal. The compound may be applied by caulking gun, trowel or knife. *David E. Long Corp.* P-158

Loxite 7020 Adhesive

Qualified under military specification MIL-C-4003, Loxite 7020 is a general purpose adhesive which has a wide variety of applications in the aircraft industry bonding vinyl plastics to nitrile rubber assemblies. It is particularly recommended for use where resistance to oil, water, fuel and other aliphatic hydrocarbons is a factor. It has good storage stability, and air dried films may be exposed to a temperature range of −40°F. to 225°F. Formulated to resist most migrating plasticizers, Loxite 7020 develops good film strength in a few hours and continues to increase in strength upon aging. *Xylos Rubber Co.* P-159

Textile Mill Tape

Composed of a specially treated kraft paper and a heat and stain resistant adhesive, Permacel 720 Textile Tape finds use as a slasher and warping tape for textile mills. It can be used on cottons and synthetic fabrics. The strong backing and high tack adhesive also permit it to be used for a wide variety of holding operations at the mills, such as holding down ends of cloth rolls and sealing paper wrappings. Because of a high degree of moisture resistance, the tape is not affected by high humidity before or after application. The tape can be dispensed manually or applied by machine. *Permacel.* P-160

Thread and Gasket Sealant

Manufactured to meet the exacting specifications of production line assembly and general maintenance, HarbinSeal sealant finds use as a pipe joint sealant, a packing lubricant, as a gasket sealant and in the prevention of thread corrosion. Produced of metallic lead held in suspension, HarbinSeal will not dry out or set-up hard. It will keep indefinitely and requires no thinner. *James K. Harbinson & Co.* P-161

Red Reclaim Adhesive

Developed for bonding fibrous material to metal, wood, plastics, etc., 15-287, a new red reclaim adhesive has a heat resistance that permits it to pass through paint retouch ovens without failure. The manufacturer states that the product is very stable in the can and the dried film has exceedingly good stability. *St. Clair Rubber Co.* P-162

Curtain Wall Sealer

A new high performance curtain wall and building maintenance sealer, off-white in color, and especially designed to blend with light colored masonry materials such as marble, limestone and concrete is now available. This liquid two-part polysulfide rubber-base product is designated Weatherban. When mixed with a curing agent, this sealer chemically cures in place to produce a solid rubber seal which possesses excellent flexibility, aging and non-flow qualities, the manufacturer states. In addition, it is said to have tensile strength, excellent adhesion to glass, marble, limestone, wood and other common building materials. The sealer has outstanding resistance to the deteriorating effects of ozone, oxygen and industrial atmospheres and remains flexible and strong under varying weather conditions. *Minnesota Mining & Manufacturing Co.* P-163

Self-Curing Liquid Resin

The self-curing liquid urea resin known as Auto-Set 31 has been developed for making particle production board easier and more uniform, especially for manufacturers with multi-platen presses. Use of the resin is said to eliminate need for catalyst mixing, minimize surface precure, reduce formaldehyde fumes before, during and after pressing, and allow for uniformly consistent manufacturing operations. The manufacturer reports that field production runs have indicated that the resin provides up to 25 per cent greater internal bond and reduces cycle time up to 20 per cent. *Borden Chemical Co.* P-164

General Purpose Adhesive

A general purpose adhesive has been announced which provides a high degree of adhesion between many surfaces through a non-crystalizing, permanent, flexible bond. The adhesive is a clear vinyl base product with a very high solids content which makes it particularly well-suited for cementing dissimilar plastics and plastics to non-plastics. *Schwartz Chemical Co.* P-165

Polyurethane Coatings

Based on polyurethane, a new series of HumiSeal coatings serve as humidity proofing agents for electronic applications. The manufacturer states that the coatings offer excellent weathering and corrosion resistance for many metal surfaces. *Columbia Technical.* P-166

TECHNOLOGY OF ADHESIVES AT YOUR FINGERTIPS

A A SERVICE

Subscribers to ADHESIVES AGE may now obtain, from one central source, technical literature dealing with all aspects of the adhesives industry. One or more of the books listed here may be of invaluable assistance to you. Look this list over and check the books suited to your needs.

- **Adhesive Bonding of Metals—G. Epstein. $2.95.** Considers adhesives used with metals, indicating when an adhesive-bonded joint is advantageous; the type adhesive to use; how to use it, and how to design the joint for optimum performance. ☐

- **Adhesive Bonding for Fibrous Glass Reinforced Plastics—H. A. Perry. $8.75.** A theoretical and practical manual on the joining of glass reinforced plastics. ☐

- **Adhesion and Adhesives—N. A. De Bruyne and R. Houwink. $13.50.** A collection of information on the scientific and technological aspects of adhesion. Part I deals with theory, while Part II is devoted to the technology of adhesion. ☐

- **Epoxy Resins—Their Applications and Technology—H. Lee and K. Neville. $8.00.** Guide to the field of epoxy resins, covering the chemistry of their preparation and applications, including a section on adhesives. ☐

- **Polyamide Resins—Donald E. Floyd. $4.50.** Discusses in detail various important applications of the polymers belonging to the polyamide resin family and includes a comprehensive section on adhesives. ☐

- **Principles of High Polymer Theory and Practice—A. X. Schmidt and C. A. Marlies. $12.50.** Study of the principles of high-polymer theory and practice, with a section on adhesives; their applications, and mechanisms and factors involved. ☐

- **Recent Advances in Gelatine and Glue Research—G. Stainsby (Editor). $12.00.** Study of Collagen, and its protein gelatine, comprising papers and Proceedings of an International Conference of the British Gelatine and Glue Research Association. ☐

- **Rubber-to-Metal Bonding—S. Buchan. $4.00.** Discusses methods for bonding natural and synthetic rubbers to metals of all kinds, for use by those who manufacture rubber-metal units, and of interest to the rubber-minded engineer. ☐

- **Vinyl Resins—Mayo Smith. $5.75.** Surveys applications of vinyl resins with information on their types, properties, chemistry, manufacture and fabrication. Includes information on several types of adhesives in this category. ☐

- **Adhesion and Adhesives: Fundamentals and Practice—F. Clark, J. E. Rutzler, Jr. and R. L. Savage (Editors). $10.50.** Papers read at a Symposium at Case Institute of Technology and a Conference in London, on the status of knowledge in adhesion. ☐

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THE FIRST REAL PROSPECTS OF TAX CUTS IN YEARS are emerging now in Washington, though actual relief is a year or two away. Hopes rest on (1) Ike's drive to cut Democratic spending, (2) the business upturn which is lifting profits—and revenues, and (3) interest in tax reform, to plug some leakages in the tax base. Reform may bring an extra $7 billion in revenue.

In the face of threatened Presidential vetoes, the Democrats cut bills for housing, airports, and depressed areas. Outlay will top Ike's $77 billion by only $2 billion in fiscal 1960, the year just starting. Revenues will exceed forecasts, so there's a chance of Budget balance. But a surplus available for tax cuts isn't likely until next year—in fiscal 1961.

The hearings on tax reform scheduled for next November will lend strength to the case for tax cuts. The reforms—the end of special exemptions—will mean more income subject to tax. The leakages which Congressmen are out to plug account for 25% or more of taxable income. The study will cover expense accounts, depletion for minerals, deductions for interest and medical expenses, income-splitting by married couples, etc.

BUSINESS IN THE SECOND HALF will continue to expand at a brisk rate—that's the size-up of leading economists in government and industry. The trend will be up even in the seasonally slow third quarter—the hot-weather period—though the sharpest gains will be coming in the final three months. By the beginning of next year, the stage should be set for a full-fledged boom. Though credit curbs will be tightening, two great plus factors will assure strength. They are rising consumer-durable sales and plant expansion.

Most key sectors of the economy will be showing substantial gains in the second half. Auto sales will continue solid, spurred by rising consumer incomes. Public works projects will be rising 10% or so. And buying for inventory should continue high—a dynamic factor in stimulating new business.

Here's what some key indicators will look like.

- Gross National Product: Total output of goods and services by year-end should be running at an annual rate of nearly $490 billion. The second-quarter rate was $478 billion.
- Industrial production: From the recent low 150's, the Federal Reserve Index will hit 156-7% of the 1947-49 level.
- Personal income: The second half rise will come to around $7 or $8 billion, reaching $383 billion by the end of 1959.
- Employment: A peak of 68 million will come in the month of October, compared with the present total of some 66 million.
- Inventories: The current $10 billion-a-year rate of buildup may dip to a still-high $6 billion rate in the last quarter.
- Auto sales: Fourth quarter volume may be up 25% over 1958.

capitol cues (con't)

CONSTRUCTION WILL BE HITTING NEW RECORDS in the second half of 1959. Home-building, which has been sensational so far this year, may slow a bit. But other types of work will expand more than enough to take up the slack. This will help not only the nation's builders, but businessmen generally. Construction is a big employer, user of materials, and buyer of equipment.

There are some powerful bases underlying this building boom. Government spending, particularly for highways, will move up. Growth of population is rapidly bolstering need for schools and housing, which in turn will lead to increasing need for stores, garages, and utilities. And rising costs are leading businessmen to build now, in anticipation of requirements.

Here is where the building gains are likely to come:
•Highways: Outlays will go up 5% or so, as the states rush to spend an extra $400 million in grants voted by Congress.
•Stores-offices: The 4% gain of the first half will double.
•Industrial: Spending will go up 5% over the current rate.
•Military: Dollar volume will rise 10% in the second half.
•Housing: Annual rate of starts will soon begin to decline. Today's annual rate of 1.3 million will fall to 1.1 million.

MORTGAGE MONEY WILL BE GETTING A LOT TIGHTER in the months to come. The supply of funds is up from a year ago but demand is rising a lot faster and interest rates are pushing higher. Conventional loans—those not backed by Federal insurance—are costing 6% in some areas. They'll go even higher. So lenders will be less willing to take on FHA loans—helping to explain why home-building activity will be declining somewhat by the end of the year.

THE GOVERNMENT'S WHOLESALE PRICE INDEX WILL RISE A BIT between now and the end of the year. The increase in these prices that businessmen pay will run ½%, maybe a little less than consumer prices. Boosts occurring in industrial items will more than offset the drops expected in farm products.

Here are some of the trends, price specialists foresee:
•Machinery will move up 5%, with the rise in business buying. The recession slump in investment kept makers from hiking.
•Non-ferrous metals will increase on higher wages and demand. Copper will be up 2¢ a pound or more...aluminum, 1¢-plus... lead and zinc, 1¢...tin, a slight gain...nickel, very little.
•Lumber will see a firming as mills revise output schedules.
•Cotton cloth is also firming as use tops '58 by some 20%.

SHORTAGES OF SKILLED HELP ARE DEVELOPING in many areas of the U.S. The Labor Department is getting reports of greater difficulty in recruiting from firms in Chicago, Baltimore, central New York, Ohio, and the Far West. The types of skills found in tightening supply include tool and die-makers, machinists, arc-welders, automobile mechanics, and electrical repairmen.

ANOTHER HUGE HARVEST IS LIKELY THIS FALL, say government farm experts, comparing well with '58's record. Plantings are high; weather has been good. The wheat crop will be down; corn will be larger—to a huge 4 billion bushels. Vegetable supplies will be greater than in 1958—mainly for celery and lettuce. Fresh fruits—peaches, apricots, and pears-will be in more abundant supply.

• Rubber-to-metal bonding agents are offered in India by a company which specializes in this field. A selection of bonding agents covering all requirements is available from a line of four different cements. The first, designated the M-Series cements are a group of bonding agents for the adhesion of various polymers to standard structural metals in one-coat applications.

A group of auxiliary bonding agents, utilized to promote adhesion of different polymers to standard structural materials, the B-Series, must be used over suitable primers and, in some cases, brass plate. The P-Series cements consist of a group of primers which develop adhesion between various polymers and standard structural metals with the appropriate B-Series cements used as secondary coats. The last group, the X-Series, are bonding agents designed to develop adhesion between unusual surfaces and hard-to-bond compounds of all standard polymers.

• The sale of adhesives in tubes seems to be expanding in the Spanish market with several companies attempting to promote their products on an increasing scale. One factory manufactures three different tubed adhesives, called Synkol, Synkolikol and Polo, all of which are sold in stationery stores, drug stores and related outlets. These special adhesives are suitable for the repair of porcelains and glass and are also used to cement cardboard, cement and similar materials.

German manufacturers apparently take advantage of the requirements of the Spanish market as the well-known adhesive Pelikanol is also represented in some of the Spanish publications. Spain offers an ever-expanding market for American adhesives which, because of their superior performance, have been accepted very quickly by the American public. It might be worthwhile for a number of American factories to investigate the potential of the Spanish trade channels.

• Winzeln adhesives, which are marketed in all parts of the world, are made in Winzeln, a little town near Pirmasens, the center of the German shoe industry. Recently, the owner of the small factory that manufactures these adhesives celebrated his fiftieth birthday. The local press honored this event by publishing several feature articles describing the growth and expansion of the little factory.

At present, the Winzeln factory trademark can be found on the labels of drums, cans and other containers in many countries including Germany, Holland, Greece, Italy, Hongkong, New Zealand, Burma, and Mexico. These drums contain many adhesives which are manufactured in Winzeln and appreciated all over the world because of their superior quality.

At the present time, forty people are working in a modern factory which had its beginnings in 1934, when two people worked in a little shack, manufacturing cements, adhesives and other materials for the shoe industry. From these very modest beginnings, a modern factory in Germany and another one in Holland, called Maikol-Chemie (Maiburg, Holland), have been established in the short period of twenty-five years. An additional factory, located in Italy, will start production this year.

In 1951, the firm's Export Department started to ship adhesives to all parts of the world, which resulted in continuously increased annual production at the factory. The modern factory contains seven large halls and underground storage tanks which are able to hold almost 500,000 pounds of solvents. There are eight trucks in use and the plant operates 24 hours a day in order to meet demand.

We are confident that American adhesives would be received quite enthusiastically all over the world, provided that American manufacturers would promote their export efforts with the same zeal and zest as German manufacturers. It might be a good idea to hire a few young chemists, train them for a few months in the present factory, make sure that they know a few foreign languages and, after their training has been finished, send them around the world for a few months in order to investigate and explore the various markets. Selling to exporters in the United States and letting them worry about what they will do with the merchandise, is not an efficient way to expand trade with foreign countries.

• America has made considerable contributions to chemical semantics. The French newspaper, *La Vie Des Metiers*, which is published in Lyon, recently celebrated the selection of the town of Berre as the first European synthetic rubber center. The newspaper pointed out that GR-S is an American abbreviation of the words "Government Rubber Styrene." This synthetic is used in the manufacture of tires. Reading the balance of the article, one is amazed at the number of American words that have been incorporated in the French article, which proves that the words that we use here in the United States are going to be adopted not only in the French language but into quite a number of other languages. A description of the organization of the factories reads as follows:

"Due to the energetic efforts of Mr. Carous, the director of the chemical factory of Berre, owned by the Shell-Saint-Gobain Company, the Shell and Chemical Products and Refinery Company of Berre, Texas-Butadine, Michelin, Dunlop and Kleber-Colombes, all of these companies have just signed a contract organizing a new corporation call Societe des Elastomeres de Synthese (Synthetic Elastomers Corporation) which will start to build a factory for GR-S rubber in Berre."

On the Continent

After explaining what GR-S means, the article goes on to point out that petroleum chemistry is a very young science in which products used for the manufacture of nylon, tergal, detergents, solvents and insecticides, are extracted from crude oil. Berre has been one of the important French centers of petroleum chemistry and its selection as the site for the new factory is justified by the proximity of the existing industries.

The petrochemical facilities were constructed in 1952 and have, since then, been enlarged considerably, particularly in 1958. Right now, they produce alcohol or ketones, carbon black and various related products. The initial capacity of the new factory is expected to be 50,000 tons per year. A subsequent expansion to 75,000 tons a year will place France in the first rank as a production center in the European common market.

• Those who have to deal with any organization in our government, are usually at a loss regarding the various departments and sections. As a rule, it takes quite some time to find out what part of the government to approach, what person to contact and, furthermore, to learn what function that particular part of the department is supposed to fulfill.

The *United States Government Organization Manual,* containing 790 pages, is an excellent book and should be on the desk of every executive. It is the official organization handbook of the Federal government and contains sections which describe the agencies in the legislative, judicial and executive branches. Further, one can find brief descriptions of the semi-official agencies and selected international organizations. This book, a treasure-chest of information, will help industry and commerce in many ways, giving a complete picture of the complexities of the government and its many sections that are devoted to public service. This manual may be obtained by writing to the Superintendent of Documents, Government Printing Office, Washington 25, D. C. It is priced at $1.50.

A similar book, entitled *Taschenbuch des Oeffentlichen Lebens 1959,* has been published for the ninth time in Germany by Dr. Oeckl and Dr. Vogel. It contains, in 612 pages, not only descriptions of the functions, addresses and names of the various departments of the Federal German Republic, but also respective data covering the states called "Laender." This book also provides a complete listing of municipal associations; data concerning the most important larger cities; descriptions of the various associations and institutions serving the contacts with foreign countries; a listing of all Chambers of Commerce; the organization of the German industry; and the political set-up and all the data required for dealing with German industry.

All this is contained in a very handy, comprehensive booklet which is sold for about $1 in Germany. The book is printed in German and in order to utilize it properly, one has to understand quite a bit of the German language. Those who know German well, will find it an indispensable aid in developing closer relations with German industry and trade. The book can be obtained by writing to the Festland Verlag G. m. b. H. Postschliessfach 649, Bonn, Germany.

• The British Plastics Federation and the British Board of Trade will have a joint stand at the International Plastics Fair (Kunstsoffmesse 1959) which will be held in Deusseldorf on October 17 to 25, 1959. As far as it is known, the following companies will exhibit: Bakelite Ltd.; Brainos & Co.; Bristol Aircraft, Ltd.; British Geon Ltd.; British Resin Products Ltd.; Durapipe and Fittings Ltd.; Ekco Plastics Ltd.; Novadel Ltd.; Portland Plastics Ltd.; Bernard Wardle (Everflex) Ltd.; and some other companies.

• R. H. Windsor, British manufacturer of plastic and rubber machinery, has now established a German manufacturing and sales subsidiary. This company will be known as R. H. Windsor Ltd. and will be located at Frankfurt am Main. It is significant that this English company is now gaining a foothold within the confines of the European Common Market. Mr. Windsor was recently in Russia and was able to secure large orders for equipment from the Russian plastics industry.

• Eighty members of the New York Society of Security Analysts, an organization which represents banks, brokerage firms, insurance and investment companies, recently toured the continent. They also stopped over in England in order to visit a number of important factories, among them Dunlop Co., I. C. I., and Courtaulds, to name only a few. The reason given for the visit is the growing interest of American investors in foreign securities. It seems that the security analysts are very interested in British industry and its operations because their program calls for visits to eighty companies.

• The International Plastics Exhibition, which opened at Olympia, London, on June 15 and closed on June 27 was highly successful. Tools, machinery, equipment and materials currently used by manufacturers were exhibited. There were also more than 200 plastic products from twelve countries. The products shown demonstrated that modern designers are thinking in terms of plastics as materials in their own right and are taking advantage of their unique properties.

• The National Council for Technological Awards, which was set up in 1955 to create and administer awards for students in technical colleges, recently established a first award, the Diploma in Technology, which is the equivalent to an honors degree of a British University. Last November, the Council announced its proposal to create the higher award of membership of the College of Technologists in order to encourage qualified men and women to undertake further study beyond the level of the Diploma in Technology. This award will be a mark of outstanding distinction granted to a student who has proved his ability by completing a substantial program of the work demanding the application of his knowledge to the solution of a problem of value to industry.

"I will concede, sir, that your new adhesive has excellent bond strength, but our problem is not quite that simple."
PAX MISSILE CORP.

• Our Mr. Missile Maker speaks for a great many adhesive users who today have "sophisticated" requirements. As a result, the product lines of adhesive compounders are becoming more complex every month.

This means an increasing demand for *quality chemical* raw materials . . . not raw materials for a new "miracle all-purpose adhesive," but raw materials with *precise and predictable properties*. Around such properties adhesives that will meet "sophisticated" demands can be formulated.

One of the best sources for quality adhesives raw materials is Reichhold Chemicals, Inc.

RCI has a full line of *epoxy resins*, phenolic resins and vinyl acetate polymers for professional compounding of adhesives with a wide range of end uses where precision is vital. From a delivery standpoint, you will also be interested in the fact that Reichhold has fifteen plants strategically located across the country. RCI delivers adhesive raw materials in drums, tank cars or tank trucks, and you can often combine shipments for real savings.

If you compound adhesives for customers whose problems are "not quite that simple," investigate the *quality resins* and *emulsions* available from Reichhold.

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The use of clays in ...

Controlling Adhesive Penetration

By A. W. CLAXTON
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Menlo Park, N.J.

Clays and other inert "fillers" are used in adhesives to either reduce costs by extension of the relatively expensive adhesive components or to improve the performance of the adhesive.

Aspects of cost reduction are readily resolved by weighing the reduction in cost effected by incorporation of inert ingredients versus the adverse effect, if any, on the adhesive performance. Cost reduction will not be considered here except in a general sense and as it results from improved performance and increased mileage.

Clays in adhesives improve their performance by (1) modifying the flow properties so as to improve application; (2) increasing the "setting" rate of the adhesives; (3) improving suspension of the adhesive ingredients, and (4) controlling the penetration. In a great many cases this last item, control of penetration, is the most significant and it will receive the greatest attention in this article. Methods of observing and evaluating the functions of clays and other additives in adhesive systems will be discussed and correlated field experience reported.

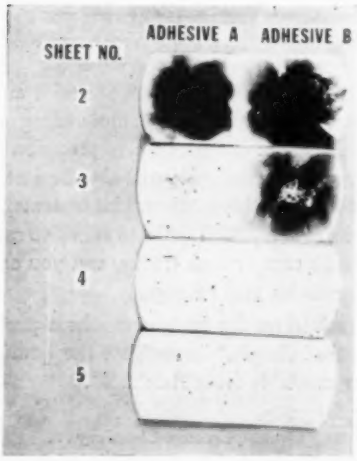


Figure 1—Typical example of results obtained in an hydraulic press penetration test.

A fundamental characteristic of most adhesives used in fastening porous adherends is their tendency to penetrate into the substrate. In most cases this is an undesirable property.

Adhesion of two members occurs at the interface or surface of the two joined members. To bring about this adhesion it is first necessary to insure that the adhesive medium "wet" or intimately contact both surfaces. This is, in fact, the first and foremost requirement for any good adhesive.

That portion of adhesive which penetrates below the surface of the materials being joined, however, contributes nothing to the accomplishment of the primary purpose. As far as adhesive value is concerned, it is simply wasted. If excessive substrate penetration is present, costs are increased, starved glue lines may result, and a wet or soggy product may lead to warpage, reduced production speed, and delays in further processing.

Solvent Loss Factor

A second characteristic of many adhesives is their dependence, at least in part, upon loss of solvent for development of a permanent "set." In today's high speed production, rapid removal of this solvent from the glue line is an ever present consideration. As production speeds are increased, the problem becomes more acute. The effect of clays upon this important action will be discussed in some detail later.

While the use of clays in adhesives to bring about a reduction in penetration has been practiced for some time, it is believed that adequate attention has not been devoted to the selection of clays for this purpose. Specifically, a realistic and practical method for determination of anti-penetration properties of clays or other additives, under conditions approximating those found in actual practice, has not been generally available.

"Penetration" tests cited in the literature appear to be completely inadequate. For example, one such test consists of applying a drop of adhesive to the surface of an ordinary blotter, applying beside it another drop of adhesive containing antipenetration additive. Observation is made of the time required for both adhesive drops to penetrate into the blotter and results are reported in terms of rate of adsorption of the two mixtures.

In another test the adhesive is simply filtered through a standard laboratory filter paper and the quantity of filtrate obtained in a given time is taken as an indication of the penetration properties of the adhesive [Vail, James G., and Baker, Chester L., U.S. Pat. 2,239,358 (April 22, 1941)].

These tests are considered to be almost solely an indication of water retentive capacity alone. They cannot be closely related to most adhesive applications in that they fail to consider pressure forces—almost universally a factor in commercial adhesive application. A test which would show the behavior of an adhesive under conditions approximating as nearly as possible the time-pressure conditions found in commercial applications, would be much more valid and meaningful.

Penetration test procedures recently developed and presented

herein are believed to have real merit in observing the effect of anti-penetration additives to adhesives and in predicting their behavior under commercial conditions. Results obtained in the field lend authority to the laboratory test procedures.

In one procedure a measured quantity of adhesive, normally 0.20 ml. is placed upon the topmost of a stack of four or five sheets of Whatman's No. 4 laboratory filter paper. The assembly is immediately placed in a 6 x 6-inch laboratory hydraulic press, where 100 psi pressure is applied for a period of 15 seconds. The assembly is then removed from the press and each sheet of filter paper is immediately and individually stained with an appropriate reagent.

For starch adhesives, a standard starch-indicating iodine solution is used; for silicates and other alkaline mixtures, phenolpthalein solution is appropriate. Photographs may be made of the individual sheets, or the sheets of filter paper themselves may be retained as a record, although the stain color is somewhat fugitive and fading will likely occur over a period of time.

The individual test papers may also be evaluated with a densitometer. This measures the density of the stain test papers and provides a numerical designation for the degree of penetration.

In this procedure, two adhesives or two anti-penetrants are usually tested simultaneously for a comparison. The type of results obtained is shown in Figure 1. Since the topmost sheet of filter paper, will in every case, show an adhesive stain, this sheet was not included in the photograph. Observation of the amount of adhesive present on each sheet in the stack of filter paper as indicated by the stain, provides a rather dramatic comparison of the penetration characteristics of the two bag seam adhesives tested in this case.

It may be noted, that the adhesive on the right penetrated completely through the third sheet as indicated by the presence of a slight stain on the fourth sheet shown. The adhesive on the left shows only a slight stain on the third sheet, indicating much less penetration.

In a variation of the above procedure, which may simulate more accurately the time pressure conditions occurring in actual adhesive applications, a device such as is shown in Figure 2 is used. This consists essentially of an ordinary iron

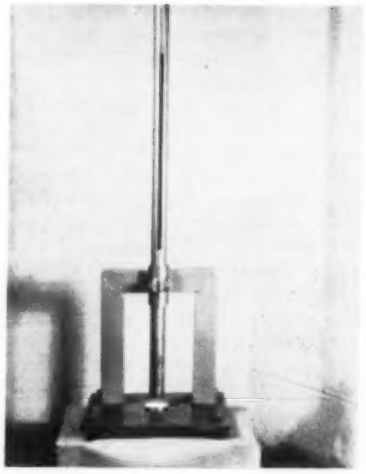
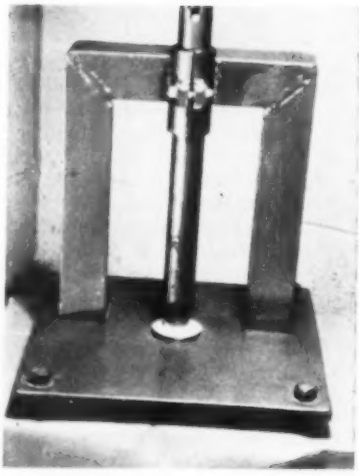


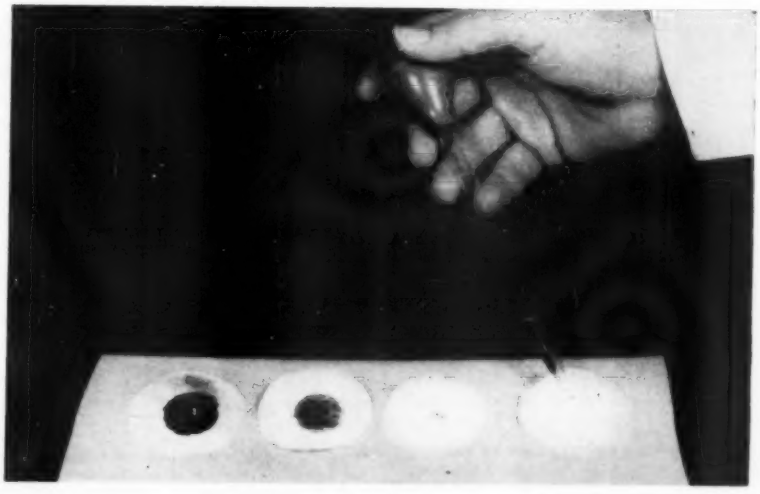
Figure 2—In an alternate testing method, a bar-stock device (upper left) was used to apply the adhesive to the filter paper.

Figure 3—The adhesive to be tested is applied (upper right) to the end of a six-inch steel bar having a one-inch diameter.

Figure 4—The bar stock falls 31 inches and strikes (right) a metal disk on which are four to five filter sheets.

Figure 5—Amount of penetration is brought out (bottom) by staining with a reagent: iodine solution for starch adhesive, phenolpthalein solution for alkaline mixtures.





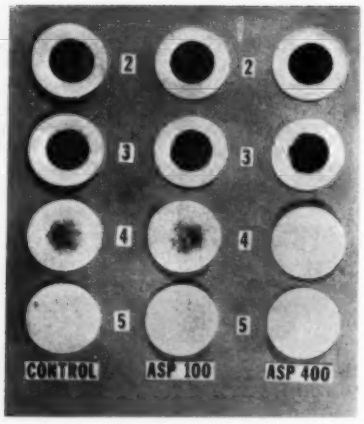


Figure 6—The effect of clay particle size on the penetration of a starch adhesive.

pipe, 1 1/16" inside diameter, supported in such a manner as to insure the pipe is perpendicular to the supporting base.

The adhesive, normally 0.10 ml., is applied to the end of a six-inch long, one-inch diameter steel bar stock as shown in Figure 3. The bar stock is then inverted and allowed to fall a distance of 31 inches onto a metal disk on which has been placed a stack of four or five sheets of filter paper.

The position of the bar stock after it strikes a stack of filter paper is shown in Figure 4. The individual sheets are then stained and evaluated in the manner previously described, and as shown in Figure 5.

A chief advantage of this test procedure over the procedure using the hydraulic press is its reproducibility. Variations in elapsed time between the application of the adhesive to the filter paper and the moment pressure is applied are obviously minimized. In addition, pressure involved is instantaneous. In this respect at least, this procedure comes closer to conditions prevailing in actual usage than does the hydraulic press method.

The excellent reproducibility obtained with this procedure obviates the necessity of testing two or more adhesives simultaneously, which, of course, would be impractical at any rate with the technique. Results obtained may be recorded and filed and are relatable to results obtained when the test is performed at any other time.

This is not true in case of the hydraulic press method in which two or more adhesives must be compared. In the performance of the test using the "falling weight" method, care must be taken to insure that the device is level in order that the bar stock may strike the filter paper at a true perpendicular.

Both of the test methods described have certain limitations. Most important of these, and most restrictive, is the necessity for the use of laboratory filter paper, which injects an artificial aspect to the results. However, this is necessary for the following reasons: (1) the starch-iodine stain is difficult to see on a great many stock papers used in the paper converting industry; (2) only the more porous and lighter weight grades permit penetration through more than one sheet. These factors virtually preclude the use of commercial stock paper in the test procedure.

Incidentally, Whatman's No. 4 filter paper was selected after trying a wide variety of papers with this procedure. The primary criterion in the selection of this paper was the necessity for penetration of the least penetrative adhesive through at least one sheet of paper, a basic consideration if the test was to be useful. Despite these restrictions, however, the procedure has been of considerable assistance in gaining further insight into the function of adhesive additives of the types here discussed.

Generally speaking, the falling weight penetration procedure is not suitable for testing the penetration properties of very viscous adhesives. With such highly viscous adhesives the hydraulic press technique is indicated.

One of the most outstanding contributions of these penetration tests has been the insight gained into the effect of clay particle size upon penetration of adhesives. It has been thoroughly established that clays differ widely in their ability to control penetration and this function is based to a very large extent upon particle size and particle shape. Some rather unexpected conclusions have been reached.

For example, based upon extensive experience with the separation of water from clay slurries by filtration, one might expect that a clay in which the particles are of small size would be more efficient in controlling adhesive penetration than would a clay of relatively large particle size. This is based upon the knowledge that small particle size clays filter slowly, a reaction believed to be a result of the dense packing of particles to form a barrier to the passage of water.

Contrastingly, a large particle size clay filters very rapidly, indicating easy and rapid passage of water through the filter cake. The filtering tests for penetration properties, mentioned earlier, reflect this fact. However, tests for penetration in which pressure is used indicate that the reverse is true and that relatively large plate-like particles are more effective in controlling penetration than smaller size particles.

Effect of Particle Size

In studying the effect of particle size upon adhesive performance properties, particularly pertaining to penetration, two water-washed, fractionated, kaolin clays were selected which differed widely in particle size. ASP 100 has an average equivalent spherical diameter of 0.55 microns while ASP 400 has an av-

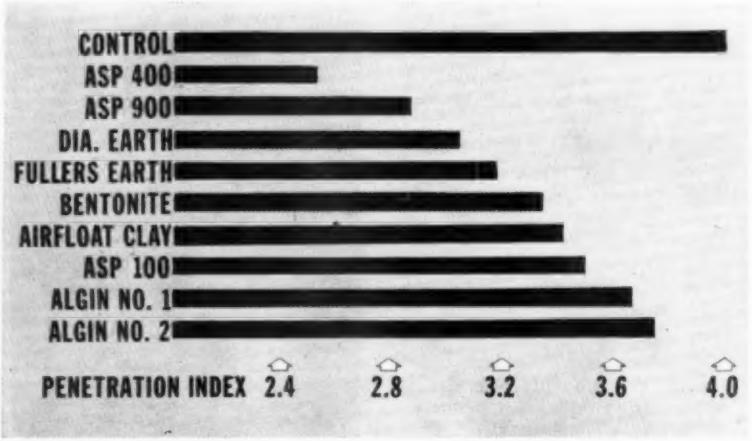


Figure 7—The results of tests made to evaluate the effect of additives on the penetration of adhesives provide a comparison of three clays differing in particle size.

erage particle size, on the same basis, of 4.8 microns.

To illustrate the effect of particle size upon penetration, each of these two clays was evaluated in a starch corrugating adhesive. Their penetration behavior is shown in Figure 6.

It can be readily observed that the ASP 400 was the most efficient in controlling penetration. As a matter of fact, ASP 100, the fine particle size clay, exhibited very little if any control over penetration in this adhesive medium, which is in contrast to the results which might be predicted on the basis of filtration experience.

The extremely effective anti-penetration action of ASP 400 is believed to be a function of its particle size; that is, the presence of a high percentage of large particles. Commercial experience in the use of these two clays adequately confirms the superior penetration control action of ASP 400.

A pending U. S. patent application, filed in the name of the writer and relating to this subject, has been allowed and the patent is expected to be issued to Minerals & Chemicals Corporation of America in the near future.

Many Clays Evaluated

A wide variety of clays and other additives commonly used for penetration control in adhesives was evaluated and their effect upon penetration is illustrated in Figure 7. The longer bars indicate relatively deep penetration of the dextrin laminating adhesive used in formulating the adhesives tested for this comparison. The shorter bars indicate relatively less penetration.

ASP 400 and ASP 100, described earlier, are relatively large and small in particle size, respectively. ASP 900 is intermediate in particle size between ASP 400 and ASP 100. Thus, a comparison of three clays differing in particle size is provided. It may be seen that, based upon these results, penetration control is directly influenced by particle size, the larger the particle size the greater the control of penetration. This rather general statement may not be true in all cases, particularly when comparing materials which have a cubical or spheroid shape. The conclusion is based here on the performance of platy particles.

The assignment of values to the various products shown in Figure 7 requires some explanation. A whole number was assigned as indicating the number of sheets of filter paper which were completely penetrated; a fractional number was assigned to represent an estimate of the amount of adhesive present on the next lower sheet, based upon a value of unity for the preceding sheet. This assigned numerical value is called a penetration index.

For example, a reading of 3.4 indicates that three sheets were penetrated completely and the fourth sheet stained to a rating of 0.4. While this assignment of penetration value is somewhat arbitrary, it served to provide a useful comparison of the anti-penetration properties of the various materials tested.

It was previously pointed out that the first requirement for a good adhesive is that it must wet the two adherends. This is quite frequently a problem in commercial practice particularly where materials which have been sized to a water resistant condition are being formulated. It often becomes necessary to either modify the adhesives or modify the application in some manner so as to improve the wetting ability of the adhesive.

The use of a wetting agent in an adhesive is believed by many to result in an increase in penetration. Figure 8 compares two adhesives, identical in formulation with the exception that one has been modified with the addition of a wetting agent. The viscosity of both these adhesives was 60 seconds. It can be seen that despite the modification with a wetting agent, the penetration of the two adhesives was quite similar.

These results emphasize that use of a wetting agent does not necessarily result in an increase of penetration. However, conclusions should not be made to the effect that wetting agents therefore have no place in adhesives. On the contrary, rapid wetting of materials by adhesives is extremely important in today's high-speed operations and will become more of a problem as production speeds become ever faster.

The true function of wetting agents, however, is believed to be an increase in the speed of wetting and not necessarily an increase in penetration. The so-called "bite" of an adhesive, in many cases, may be related incorrectly to penetration rather than to wetting.

While addition of a wetting agent to adhesive formulas has been effective in improving their wetting ability, treatment of the adherends with a dilute solution of wetting agent just prior to adhesive application

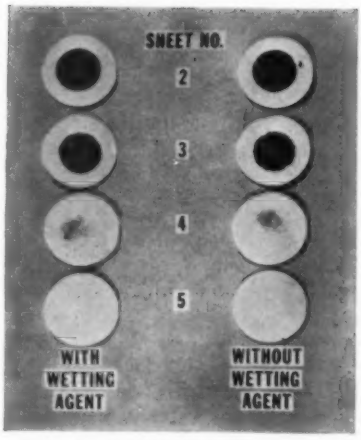


Figure 8—Tests made with and without wetting agents show their effect on penetration.

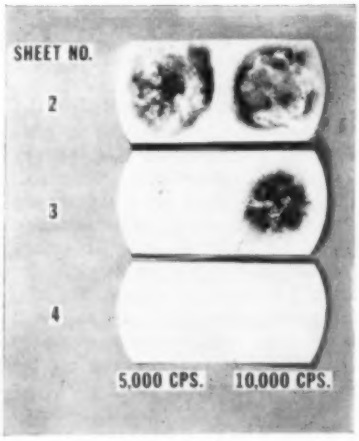


Figure 9—The effect of adhesive viscosity on penetration is illustrated.

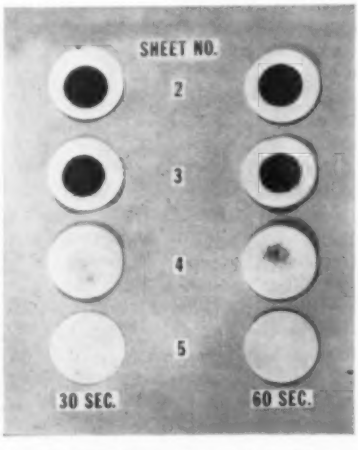


Figure 10—A comparison of the penetration of two starch adhesives differing in viscosity.

Figure 11—Fiber tear after 20 seconds is shown in a tack development test.

has been found to be even more effective. This may be accomplished by a spraying or wiping application, and should be done immediately before the adhesive is applied.

It is frequently believed that the penetration of an adhesive is proportional to its viscosity, at least as viscosity is commonly measured. This apparently is not necessarily true, at least over a wide viscosity range. To illustrate this, laboratory tests of two adhesives having the same formulation, except for the anti-penetration agent used, showed penetration performance contrary to what might be predicted on the basis of viscosity.

Penetration test results obtained with these two adhesives are shown in Figure 9. The adhesive on the left had a viscosity of 5000 cps. and the one on the right had a relatively high viscosity of 10,000 cps., as measured with the Brookfield viscometer. Despite the higher viscosity of the adhesive on the right, it is obvious that it penetrated more deeply into the stack of the filter paper than did the low viscosity adhesive.

Similarly, a comparison of two corrugating starch adhesives with viscosities of 30 and 60 seconds, as measured with an orifice-type viscometer, is shown in Figure 10. Despite the substantial difference in measured viscosity of these adhesives, there appears to be no difference in penetration properties. Incidentally, no anti-penetrant was used in these two adhesives.

As a result of these studies it was concluded that under conditions where pressure is used, wide ranges of viscosity have little effect upon penetration of the adhesive. Viscosity would obviously be a big factor in penetration into porous medium where no pressure is used. Since pressure is common to almost all adhesive applications, it seems safe to conclude that the effect of viscosity upon penetration is not an appreciable factor.

Certain clays have been found to be very effective in minimizing the viscosity reduction brought about by the shearing action of pumps used in recirculation and by the application machinery itself. Such loss in viscosity is a particular problem in the corrugating industry, for example, where ungelatinized starch comprises a main portion of the adhesive.

A change in viscosity during use of a particular batch of adhesive necessitates very careful attention to the paste application clearance settings and, at best, results in waste and inefficiency of the adhesive. A pending patent application, assigned to Minerals & Chemicals Corporation of America, describes the action of a particular type of Fuller's earth, attapulgite, (trade name—Attagel 20), in counteracting this viscosity loss.

A liquid slurry containing this product may be greatly increased in viscosity if shear forces are applied. In fact, the product is used commercially in the preparation of gels in this manner. When added to a corrugating starch paste with mild agitation, the increase in viscosity of Attagel 20 resulting from the high shear forces present in pumping offsets the loss in viscosity of the starch, thus stabilizing viscosity at a uniform level.

Maintaining Viscosity

Typical of the results obtained with use of Attagel 20 is the experience in one corrugating plant where viscosity was maintained above the established critical operating level of 30 seconds (orifice-type viscometer) when Attagel 20 was used. Previously the viscosity level had often dropped from 40 seconds to 17 seconds during use of a single batch.

Such an improvement in viscosity stability obviously has very important advantages from the standpoint of maintaining a uniform application of adhesive with minimum wastage and improved efficiency of the adhesive. For example, in one plant adhesive consumption was reduced by 20 per cent through the use of Attagel 20.

Rate of tack development is a major consideration in adhesive applications. With those adhesives in which tack is developed, at least partly, by loss of solvent, clays are quite effective in increasing the rate of tack development. The function of clays here is believed to be twofold.

Figure 12—Part of same test series shows fiber tear after 30 seconds.

Simply increasing the solids content of an adhesive will result in application of less solvent along with the adhesive. Removal of solvent from the glue line thus becomes more rapid, with a resultant increase in rate of tack development. The relatively inexpensive clays provide an economical way to increase solids content.

Secondly, use of clays effective in controlling penetration will usually permit the application of less adhesive, since the adhesive is held on or very close to the glue line. Application of less adhesive means, in turn, application of less solvent which permits more effective tack development.

To illustrate the action of clay in increasing the rate of tack development, two adhesive formulas were prepared, consisting primarily of dextrine, for use in formulating spiral-wound fiber tubes. One formula contained kaolin in amounts equivalent to 25 per cent of the weight of the dextrine used. The other adhesive contained no additive, but was otherwise identical.

These adhesives were applied in a film one mil in thickness to a section of chipboard used in the manufacturing of paper tubes. Another sheet of chipboard was immediately laminated to this by rolling with a two-kilogram balance weight. While the pressure forces applied were not

Figure 13—Fiber tear after three minutes is nearly equal in both adhesives.

necessarily duplicates of those used in commercial practice, the relatively low pressures used did simulate those followed in the manufacture of spiral-wound tubes.

In repeated tests, the laminates were separated by hand-rupturing along the longitudinal axis of adhesive films after varying time intervals under pressure. The fiber tear occurring in one such test after 20 seconds pressure is shown in Figure 11. The adhesive containing clay is on the left, the controlled adhesive without clay on the right.

It is quite evident that the adhesive containing clay exhibits more fiber pull than the control. Fiber tear after 30 seconds under pressure is shown in Figure 12. Here again, fiber tear is greatest with the adhesive containing clay.

Fiber tear after three minutes under pressure, shown in Figure 13 in this series, is nearly equal with the two adhesives. Bond strength of the adhesives, as such, was not determined. In commercial production of tubes using clay-modified formulas similar to that described above, production speed has been increased, slippage on the winding mandrel has diminished and an increase in bond strength was noted.

In addition, so-called "dog ears," resulting from delamination at the ends of cut tubes, were decreased, as was the problem of fiber "curling" in dimension sanding of convolute-wound tubes. All of these observations tend to confirm the laboratory demonstration of increased rate of tack development brought about by the use of a suitable clay.

In the production of the so-called 30-30-30 asphalt-laminated Kraft paper, in which asphalt serves as the adhesive, penetration of the asphalt is usually so excessive as to be plainly visible on the surface of the finished product and in some cases to strike completely through the paper. In addition to improving the appearance of the sheet, a decrease in penetration of the asphalt should diminish the problems connected with bleeding of the asphalt under certain storage conditions.

A clay of known value in controlling penetration of starch adhesives was added to molten asphalt in the laboratory prior to the lamination of the Kraft sheets. Films of the asphalt-clay mixture were applied to a sheet of 30-pound Kraft which was then laminated with another similar sheet.

A laminated sheet in which the asphalt-clay mixture was applied adjacent to the control containing no clay is shown in Figure 14. The improvement in appearance of the sheet containing the clay anti-penetrant is easily seen. A conclusion favorable to the use of clay for penetration control in this application seems well justified.

Fiberboard Penetration

Certain advantages in effectively controlling penetration, particularly with respect to mileage increases, are perhaps more readily apparent in the production of solid fiberboard. In one trial run, two laminating pastes were prepared with a dextrin-clay ratio of 70-30 at a total solids concentration of 40 per cent. One of the pastes contained a diatomaceous earth and the other contained a kaolin determined by laboratory tests to be effective in controlling penetration.

A penetration test of these two adhesives was made using the hydraulic press technique and the results of this test are shown in Figure 15. The kaolin, the adhesive on the right, exhibited superior control over penetration. In the production of multi-ply solid fiberboard, the unique ability of this particular clay to prevent excessive migration of the adhesive from the glue line was reflected in a substantial increase in mileage over that of the adhesive containing diatomaceous earth.

Optimum bond strength with the kaolin-modified adhesive was obtained with a spreading rate of 2.7 pounds of adhesive solids per 1000 square feet of glue line. The adhesive containing diatomaceous earth required the use of 4.8 pounds of

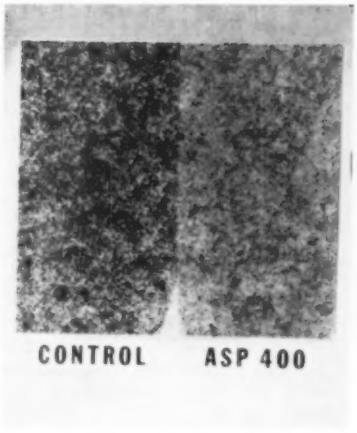


Figure 14—Comparison test shows the effect of clay on asphalt adhesive penetration.

adhesive solids per 1000 square feet of glue line for comparable bond strength. In addition to the increase in mileage, boards produced with the adhesive formulated with kaolin, were drier and harder.

In the production of grocery bags and multi-wall shipping bags, the use of a properly selected clay has been shown to decrease or eliminate waste due to strike-through of the adhesive, speed up tack development and production speed, and increase mileage.

Emphasis throughout this discussion has been on functional improvement of adhesives through a better understanding of penetration and the selection of clays best adapted for its control. There may be cases where a reduction of penetration would be undesirable. In such applications, where increases of solids content and improvement of suspen-

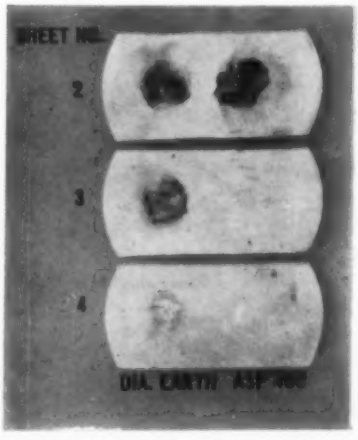


Figure 15—Test results point up the superior penetration control of kaolin additive.

sion of adhesive solids might still be desirable, clays may be selected to fit these requirements. Similarly, studies of clays in starch systems have been emphasized. The functions performed by clay may be and are being put to good use in such other adhesives as sodium silicate, synthetic resins, and in animal adhesives.

In the production of plywood, for example, clays have been used to replace a portion of a more expensive extender commonly used, and to aid in the control of penetration of adhesive through thin veneer sheets. An adhesive possessing high "shear" strength and low "tensile" strength for use in palletizing of bagged materials has been produced through the incorporation of adequate quantities of a suitable clay. Such an adhesive permits removal of bags from the pallet without tearing, yet has sufficient strength to insure that the pallet structure is maintained during shipment. Similarly, the use of clay in case-sealing adhesives will permit easy opening of cartons.

Other properties of clay must not be ignored if maximum benefits from their use are to be obtained. A clay should obviously be grit free and nonabrasive, either in slurry form or as a part of the adhesive film. Excessive settling of the clay in an adhesive is also undesirable. The effect upon application flow properties caused by the addition of clays should be established prior to actual use in the production line.

The need for careful attention to the functional properties of clays or other additives to be used in adhesives is of paramount importance. Such additives differ widely in performance, particularly with respect to penetration control. It has been shown that viscosity is not closely related to penetration as is often believed. Similarly, the addition of a wetting agent to adhesives does not necessarily increase the penetration, but does serve a useful purpose in improving the wetting ability of the adhesive. The use of properly selected clays may greatly improve the functional behavior of adhesives and permit the production of better products at faster speeds and lower cost.

About the Author . . .

A. W. CLAXTON holds a Bachelor of Science degree from the University of Georgia, and pursued his advanced studies at Mercer University. He has been with the Minerals & Chemicals Corporation of America for 10 years. Mr. Claxton is presently research supervisor of research and development work in the use of clays in adhesives and paper coatings. During World War II he was a pilot in the United States Army Air Corps, seeing service in Africa and the Pacific Theater.

Waterman Pen Company Finds That . . .

Fast-Setting Adhesive Cuts Costs

Assembler screws the adhesive-spread coupling into the barrel section of the pen. Notice special cradle for adhesive supply.

The Waterman Pen Co., Seymour, Conn., recently effected a significant savings in production time and costs, by introducing a new adhesive which cut from days to minutes the necessary elapsed time between two assembly steps for its popular cartridge pen.

In assembling the model CC-298 pen, two barrel sections of the unit are joined with a coupling threaded at both ends. To make sure that the user will remove only the upper barrel section when inserting a new cartridge into his Waterman pen, the lower section is cemented to the coupling.

While the use of conventional adhesives provided a sufficiently strong bond, quality control checks could only be carried out several days after the actual application because of the long curing time required. This created a costly bottleneck in Waterman's assembly line.

After considerable experimentation with a wide variety of adhesives, Waterman production engineers decided to adopt the use of Eastman 910. This adhesive has as its main component a reactive material known chemically as methyl 2-cyanoacrylate.

In the new production setup, the adhesive is applied by assemblers from small polyethylene bottles set in wooden cradles just above the assembly point. Within a few minutes after application, a sufficiently strong bond develops so that the next assembly operation can be carried out. About one ounce of the adhesive serves to assemble 1000 pens.

Adhesives in the Cosmetics Industry

Making milady (and milord) attractive requires a wide variety of adhesives for different purposes

STAFF REPORT

Cosmetology—the art and science of making milady beautiful—has entered a phase in which adhesives are playing an increasingly important role. There are many cosmetic areas in which adhesives are now finding use in the attachment of such items as wigs, eyelashes, fingernails, beauty patches and even eyebrows.

One of the leading companies engaged in the production of artificial eyelashes is Campus Chimes of New York City. Headed by husband and wife research chemists Saul and Marguerite (Bertrand) Goodman, the company has been actively engaged in a search for adhesives to meet the requirements of eyelash adhesion.

The attachment of false eyelashes is not a twentieth century development. False eyelashes have been used for centuries, dating to Cleopatra's time. At one time, real hair was utilized for eyelashes and affixed to ladies of nobility by the use of elementary glues. Traditionally, little bands of thread have been and still are used to bind together real hair into an over-all eyelash which is cemented into place.

Though artificial eyelashes today are often made of real hair, Campus Chimes uses Mylar film for this purpose. The final end product is attached to the eyelid with a pressure-sensitive, non-drying adhesive.

The lashes themselves are manufactured in a die-cutting process from a strip of transluscent Mylar film. Prior to the die-cutting operation, the Mylar strip is pigmented with polymeric plastic materials to give the eyelashes a lifelike color and look. The lashes are curled by differential shrinkage of the coating.

The final product is strong, reusable and has a natural rather than a "theatrical" appearance. The eyelashes are quickly and easily applied and removed.

As the adhesive involved comes into direct contact with the skin of the user, unique problems come into play. The adhesive must be non-toxic and non-irritating to the skin. It must have hydrophilic properties, that is, it must adsorb perspiration. It must be flexible, for a non-flexible adhesive would crinkle the skin producing a pinched look. Above and beyond all these requirements, the adhesive must keep the eyelashes firmly in place and must permit easy removal.

Compounding the Adhesive

The adhesive compounded by Campus Chimes for this purpose involves a number of ingredients. It consists of 25 per cent Piccopale Resin 100; 25 per cent Vistanex; 5 per cent Cab-O-Sil; and a U.S.P. Lanolin base.

The Goodmans explain that the Piccopale finds use as a hardening agent. Vistanex, a transparent, tasteless, non-toxic polyisobutylene with a high viscosity, provides the necessary adhesion. The Cab-O-Sil is used as a dispersing agent. The entire mixture is compounded in a Hobart Mixer. The Piccopale is melted down at 212°F. and then the Vistanex is added followed by the Cab-O-Sil. The lanolin base is the final ingredient to be added to the mixture. No solvents are used.

The final product is a concentrated paste. No drying time is required after application. The adhesive will hold even when it comes into contact with cold cream or perspiration. The eyelashes remove easily with no pulling on the wearer's lids, while the adhesive itself may be removed with cold cream.

This adhesive may also be used to cover skin blemishes, and discolorations. In this application, Chimes' lanolin adhesive is blended with cold cream and rubbed over discolored areas. The area is powdered first with bath powder, and then with face powder, until there is no stickiness on the surface. According to Campus Chimes, this covering will hold up to a whole day of swimming and sports. This covering may also be removed with cold cream.

Adhesives for beauty patches, eyebrows and fingernails, pose similar problems. False eyebrows, recently introduced by Elizabeth Arden, are made of human hair. Each hair is individually attached to a single mesh of nearly invisible netting. The netting is flexible enough so that the wearer can adjust the shape of the brow slightly. This means that the adhesive employed must also be flexible—not only to allow for eyebrow adjustment—but to permit natural facial expression.

Application of a false eyebrow is said to be a two-second job. First, the back of the false eyebrow is coated with a specially compounded

non-toxic, flexible adhesive. The eyebrows are then pressed gently into place. Removal is simple and painless.

Requirements for fingernail adhesives are less stringent in that flexibility is not nearly so important. Non-toxicity is a must, however. Moreover, the adhesive employed must be waterproof so that the user can wash the dishes with impunity.

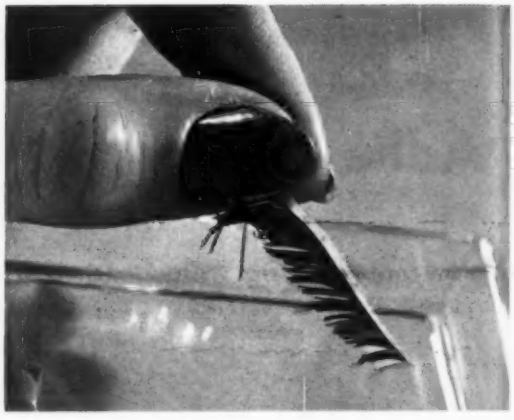
The adhering of wigs, toupés and hairpieces also poses problems involving toxicity and effective bond, in addition to other complicating factors. A custom made item based on a fabric foundation, a hairpiece requires careful treatment. Adhesives must be strong enough to keep it in place but must not deteriorate its foundation or cause accumulation of a coating that would warp its shape.

The House of Louis Feder, Inc., of New York City, specializes in the production of custom styled hairpieces for both men and women. Beginning with a fitting, the area of the head to be covered is outlined with a soft pencil. A special thin moistened paper is laid on and reinforced to pick up the outline underneath.

When the impression is set, the paper is cut and trimmed to form the basic contour pattern. Using this pattern and a wooden block which matches the head size and general shape, Feder makes the foundation from fine silk gauze material.

Clusters of three or four hairs in a blend of shades that will match the haircoloring of the user are then hand crocheted into the foundation in a ratio of 750 to 1500 hairs to one square inch of material. The finished product is refitted and barbered so as to merge naturally with the wearer's own hair.

The adhesive used to keep the hairpiece in place is Johns-Manville's Dutch Brand double coated, pressure-sensitive tape. A rubber-based adhesive, it has a strong, closely woven cotton fabric backing and a special liner on the top side to prevent adhesion to the roll.



Die-cut DuPont Mylar film is used to make artificial eyelashes. They are put on with a specially compounded adhesive.

Tape is particularly suitable in this application because the adhesive material will not seep into the fabric and also because it is not necessary to wait for the adhesive to set before application. It is renewable, secure, undetectable and resistant to both perspiration and water. The adhesive also retains its strength while in use and, in fact, body heat increases its bonding strength. The good shelf life of the tape makes it possible to store quantities at a time.

The tape must be cut and applied by the wearer. For men, Feder suggests the use of three strips: one on each side converging to the peak and the other at the back contour. If the tape has been chilled before cutting, it is easier to handle and it has been found that this is not detrimental to the bonding strength of the adhesive as body heat restores its usual tackiness.

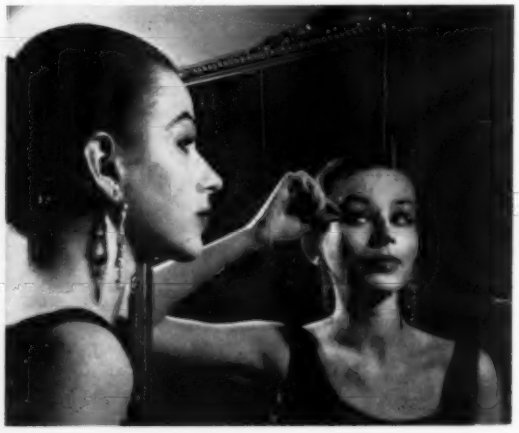
The tape may be left on a hairpiece for as long as three or four days. When this is done, however, a liquid adhesive, usually spirit gum, is applied to the side of the tape which adheres to the scalp before the hairpiece may be worn again. Users are warned to spread the liquid adhesive sparingly and not to permit it to seep into the surrounding foundation. This would cause matting of the hair and deterioration of the fabric.

In so sensitive an area, there is a constant search for materials that will help the user to feel secure and comfortable and that will minimize his inconveniences. Ben Z. Kaplan, who is associated with Feder, believes that users would feel more secure if flesh colored tapes were used.

Tape Reusability

Although the tape is not generally detectable, if improperly applied, it is possible that some of the white would show between the scalp and hairpiece. Flesh colored tapes would obviate fear of detection. Mr. Kaplan also feels that the use of a hairpiece would be simplified if the tape were reusable. Present tape loses its tackiness when it is detached from a surface, he states.

It is estimated that a hairpiece



Application of Chimes eyelashes is a simple operation. Designed for daily use, they are not theatrical in appearance.

Note: Piccopale Resin 100 is produced by Pennsylvania Industrial Chemical Corp., Clairton, Penna.; Vistanex is produced by the Enjay Co., Inc., New York, N. Y.; and Cab-O-Sil by Godfrey L. Cabot, Inc., Boston, Mass. Hobart Mixers are produced by the Hobart Manufacturing Co., Troy, Ohio; Dutch Brand Tape is produced by Johns-Manville Corp., Chicago, Ill. Mylar film is a product of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

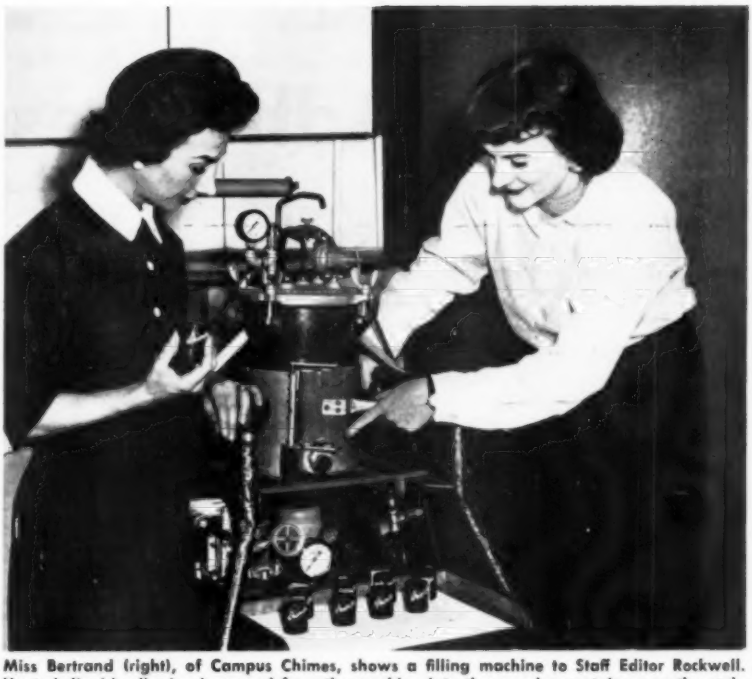
may be applied in about the time it takes to comb one's own hair. The use of pre-cut patches, however, would make it possible to apply the hairpiece much more easily.

Problem of Solubility

It is also of utmost importance to keep the adhesive out of the hair. This is not a problem in use as the adhesive on the tape will not seep into the fabric. However, in cleaning the hairpiece, an adhesive that is less soluble in the usual cleaning fluid employed might be desirable. Unless the user is familiar with the problems, he may permit the adhesive to seep into the hair and fabric while it is dissolving.

Generally, baldness is thought of in connection with men, but women, too, have been faced with this problem. Alopecia, a nervous disease, will cause partial or complete baldness in both men and women. Where the baldness is complete, a woman's wig is made in the form of a closely fitted hood. Where the hair has been lost in a patch, a "problem piece" is designed and constructed to fit the bald spot. This piece is also held in place with a pressure sensitive adhesive.

The major advantages adhesives offer in any cosmetic application are, of course, that they bind one thing to another without themselves being apparent. In use on the human body, any artifice that is glaringly obvious defeats its own purpose. It is apparent then, in cosmetology, adhesives perform a function for which nothing else can serve.



Miss Bertrand (right), of Campus Chimes, shows a filling machine to Staff Editor Rockwell. Heated, liquid adhesive is poured from the machine into the wooden containers on the rack.

How to Install Mosaic Glass Tile

Contractors working at an Indianapolis department store building recently employed an innovating rubber-cement technique to make a 7000 square foot mosaic tile installation in record time.

Said to be one of the first major changes in a decorative art popular since the Byzantine era, the new technique makes it possible to set the tiny glass tiles at a speed comparable to that of floor tile installations. Developed by Blakely Granite Co., Indianapolis, Ind., it relies on the substitution of liquid rubber for water as a binder in tile cement.

Using the rubber-cement method, installers working on the exterior walls of a new suburban branch for L. S. Ayres and Co., Indianapolis, were able to set the attractive glass tiles at the rate of 140 square feet daily per two man crew. By using a specially formulated rubber product designated as Laticrete, they were able to cut the working cure of the cement to five minutes.

In addition to speeding installation time, the new technique is especially valuable on exterior walls because it increases that cement's adhesiveness and makes it waterproof. Moisture cannot penetrate to loosen the tiles or cause them to pop off as trapped water freezes during the winter.

In contrast to the usual wall tile setting methods, mosaic units being installed with rubberized cement are set from the top of a wall down. The cement is sticky enough to hold the tiles in place until it cures, and working from the top down speeds the job.

The postage-stamp size tiles are imported from Mexico or Italy and delivered glued face down to foot-square paper sheets. In installation, a smooth and level wall area large enough to accommodate five or six sheets is coated with ⅛ of an inch of rubberized cement. The sheets of tiles are coated with enough cement to fill the thin space between the tiles and the hollows formed by the rounded reverse surfaces.

Entire sheets are then laid in place on the prepared area and a light pounding with a wooden block imbeds them in the rubberized concrete. The cement has sufficient adhesion to hold the sheets in place instantly. However, it allows the sheets to be moved slightly for proper positioning.

In about five minutes, the cement has cured sufficiently so that the paper backing can be moistened and stripped away. After the cement has set for a short while, the tile surface is scrubbed with a brush and water to remove cement from the glass face. A mild acid wash is used to clean the surfaces completing the job.

Note: Laticrete is a product of the Naugatuck Chemical Division, United States Rubber Co.

Adhesives for Flooring

The faithful performance of flooring materials now commonly used depends to a large extent on the proper selection and application of the installation adhesive. It is important, therefore, that in determining the suitability of an adhesive for a given job proper consideration be given to three prime factors: the flooring product, the surface to be covered, and whether that surface is located at, above or below grade.

Because the problem is so little understood, faulty flooring installations become a source of irritation to the architect, the manufacturers of adhesives and surfacing materials, and the homeowner. The situation presents a challenge that requires the understanding, cooperation, intelligence and patience of all concerned.

One of the first things to be done is to make it crystal clear that an adhesive is not a miracle material —no matter how good it is. It has its limitations in use, especially with diverse flooring products and under specified conditions.

Tracing the Problem

In examining problems of faulty flooring installation, the feeling in the industry is that very often the failure may be traced back to the architect of the project. Specification of the wrong type of flooring material for a given job will, of course, doom the installation from the start. The specification error may be due to ignorance or it may be the result of pressure on the architect from the owner or sponsor of the project in question.

In either case the error is often compounded because the architect neglects to discuss the problem with technical representatives of the manufacturer of the flooring material or the adhesive. It should be emphasized that there is sufficient technical data available to enable determination of whether or not a given flooring material and adhesive can be employed together on a specific project. The problem lies in the use and assimilation of the available material.

For example, it has often happened that an impermeable surfacing material such as rubber or vinyl homogeneous tile will be specified for a concrete slab-on-grade where the drainage beneath is poor, no waterproof membrane provided, and the outside perimeter of the slab lacks waterproof heat-insulation material.

Under the conditions described above the failure of the installation may be traced to one of two factors: the improperly drained off hydrostatic head of surface water, or condensation caused by the lack of waterproof heat-insulation material. Since an alcohol based solvent is employed with adhesives for cementing either rubber or vinyl, the water resulting in either case has a solvating effect on the adhesive and causes lifting or loosening of the tile.

The lesson to be drawn from the above example is that the proper selection of the flooring material must be made at the time plans for the entire structure are being considered. If, in the example given, the architect knew that the owner wanted an impermeable flooring material, provision should have been made for both a waterproof membrane beneath the slab, and waterproof insulation around the perimeter of the slab for its entire depth.

One source of the architect's troubles in these matters is that he tends to rely for his information on commercial literature, rather than consulting with a manufacturer's technical representative. Information in these catalogs is general in nature and cannot be used to decide on the merits of a specific application.

Another complaint brought against architects is that they will often transfer a portion of a specific flooring installation specification to another project in which the conditions vary considerably. It cannot be stressed too strongly that conditions in different jobs—sometimes even adjacent to one another—will alter the proper installation specification considerably.

Other Factors

In addition to the design of the structure itself, factors to be considered include: surface water drainage, the location of the surface to be covered (is it at, below, or above earth level?), the relative porosity or impermeability of the surfacing material, and the adhesive employed (is it pressure sensitive, thermosetting, aqueous, solvent or asphaltic based?).

It should be noted here that the problems of installation might be considerably alleviated if flooring products manufacturers agreed on common formulations which would enable a more exact estimation of the impermeability or porosity of their respective products. In this way, surfacing materials could be typed as to whether, under specified conditions, they could resist moisture of any kind.

Let us consider some of the factors influencing the selection and performance of adhesives for installing resilient flooring materials on a concrete slab-on-grade. Resilient flooring materials include rubber and vinyl—the "non-breathing" or impermeable surfacing products.

It is immediately apparent that the life and serviceability of any resilient flooring product will depend largely on the proper application of the right type of adhesive, selected with due consideration to the moisture condition of the slab surface.

What do we expect from the adhesive? It must bond the resilient flooring to the surface of the slab without chemical or physical damage to the tile. In addition, it must not only maintain its adhesive and cohesive strength, but be able to withstand any strains and stresses imposed by dimensional changes in the flooring material. The latter may result from temperature changes, moisture, aging properties, and inherent curling or shrinking tendencies due to the composition of the flooring product.

Proper Viscosity

Some adhesives contribute to the failure of a resilient type of flooring material because they lack the correct viscosity. If the viscosity is too thin, it may cause penetration of the adhesive deep into the slab. This in turn will bring about a failure of bonding power because of the lack of adhesive at the surface. A similar type of failure may result from the use of too little adhesive.

On the other hand, if too much adhesive is used, it will result in "bleeding" at the joints. It is important that suitable technical advice be obtained and the proper rate of spread, on a particular kind of surface, for a specific brand of resilient flooring product, be determined.

If installed with a water-resistant adhesive, some flooring materials will give satisfactory performance despite the presence of moisture in the concrete slab. However, many types of flooring materials and adhesive require protection from moisture. This is usually provided by a vapor barrier in the form of sheet goods such as a four-mil vinyl chloride film.

Table I—Allowable Flooring Materials for Slab-on-Ground Design According to Moisture Conditions

	Design Conditions		
Construction Item	*1*	*2*	*3*
Granular Base of Limited Capillarity	None; Very Good Drainage	None; Poor Drainage	Provide Fair Drainage
Vapor Barrier Location	None	Under Slab	Under Slab
Joint Lap Sealing	None	6" Lap Sealed	6" Lap Sealed
Flooring Materials	Group A	Group A or B	Group A or B

Note: Flooring materials in Group A include: asphalt tile, rubber tile, vinyl asbestos tile, flexible tile (unbacked), flexible vinyl sheet (moisture resistant backing). Flooring materials in Group B include: cork tile, linoleum, felt- or fabric-backed vinyl tile or sheet.

Table I presents a guide to flooring material selection under different design conditions. The construction designs given are not restricted by soil type or by location of the water table, except under conditions of hydrostatic head. The recommendations in the table are, however, subject to the following limitations:

(A) A minimum of 30 days of optimum drying conditions after the slab has been placed is considered necessary before flooring materials in Group A are installed. For materials in Group B, a minimum drying period of 60 days is considered necessary; however, 90 days is recommended. Materials in Groups A and B may be installed earlier if tests indicate that the moisture condition of the slab, in terms of relative humidity, does not exceed 75 per cent RH.

(B) Designs 2 and 3 are recommended where the concrete slab in habitable spaces is to remain uncovered and does not have a finished flooring material. Designs 2 and 3 are also recommended where radiant heat is used in the slab.

(C) For satisfactory performance under certain design conditions, some flooring materials require the use of special adhesives. The flooring product and adhesive manufacturers should be consulted.

(D) Manufacturers' recommendations should be consulted concerning the use of Group B flooring materials in geographic areas where the average annual relative humidity is 75 per cent or over.

With certain types of resilient flooring materials to be installed on suspended or above grade surfaces, advantage can be taken of sulfite liquor and asphaltic emulsions. The latter have a good degree of adhesion as long as they are not brought into contact with water, alkali and freezing temperatures. Under those conditions they would embrittle.

Table II—Chemical Type of Adhesive to be Used in Relation to Flooring Material and Surface to be Covered

Surfacing Material	*Wood Suspended*	*Concrete Suspended*	*Concrete on Grade*	*Concrete Below Grade*	*Mastic Under Layment*	*Steel, Dry, Non-Porous*
Linoleum	S	S	—	—	S, L	L
Vinyl Coated Backing	S	S	L[2], C[2]	—	S, L	L
Vinyl Asbestos	A, S	A, S, D	A[1]	A	A, D	A, D
Vinyl, Homogenous	L	L	L, C	C	L	L, C
Asphalt	A	A	A	A	A	A
Rubber	S	S	L[2], C[2]	C[2]	L	L, C
Cork	S, L	S, L	L, R	—	S, L	L

Note: Adhesive code by chemical type: A—asphaltic, C—chemical set, D—rubber/asphaltic dispersion, L—synthetic rubber latex, R—resinous, S—sulphite liquor. [1]Slab should have an impermeable membrane underneath it. [2]It is imperative that the flooring supplier can be consulted.

Table III—Chemical Types of Adhesives and Their Properties

Type of Adhesive	*Dry Strength*	*Wet Strength*	*Tendency to Stain*	*Alakali Resistance*
Sulfite Liquor	Good	Low	Slight	Low
Asphaltic	Good	Fair	Yes	Poor
Rubber Asphaltic Dispersion	Good	Fair	Yes	Fair
Synthetic Latex	Good	Good	No	Good
Alcohol Type Cumar Resinous	Good	Fair	Yes	Poor
Latex-Hydraulic Cement	High	High	No	High
Epoxy-Polyamide	High	High	No	High

Although the asphaltic type of adhesives are considered to be moderately soft and plastic, they should *not* be considered for use on or below grade. If they are so employed, the drainage of the surrounding earth should be such that there is no possibility of moisture gathering from any source.

Though asphaltic adhesives are able to "breathe," they are very much affected by reduced temperatures, alkalies, high capillarity and hydrostatic pressure. They also stain quite a great deal, especially in the form of wall bases and coves.

If ever employed on or below grade, asphaltic adhesives must have the benefit of an impermeable membrane beneath the slab or cellar floor. This will protect the adhesive from being affected either by water or the alkali in portland cement.

Guides to the selection of the proper adhesive, in relation to the surfacing materials to be used and the design conditions to be met, will be found in Tables II and III.

Gluing Textile Sample Cards

Mechanized production line meets high-run, low-cost requirements

Gluing operations requiring high volume production are carried out with surprisingly little cost by Reliable Sample Card Co., Inc., Brooklyn, N.Y., one of the largest textile sample card houses in the country.

Each year, Reliable turns out several hundred million sample cards, books and swatch sheets for textile manufacturers, cutters, wholesalers and retailers. Its new plant is a $1,000,000, 63,000 square foot building, complete with new and modern processing equipment.

Working on an 8:30 A.M. to 10:30 P.M. production schedule, Reliable operates a two-shift setup. The company uses 14 light duty, type-Z gluing machines. Each of these units stands at the head of a production table where it performs gluing duties for from four to eight sample book assemblers. Gluing operations are mainly concerned with edge coating but may also include full sheet coating, gluing of cloth covers, laminating and gluing titles, and miscellaneous other jobs.

All work at the gluing tables is done by non-skilled workers who in a few minutes can be easily trained to operate the machines. Besides being an important cost saving, the use of non-skilled labor eliminates problems of employee absence or turnover.

The versatility of mechanical gluers makes them particularly important in the sample card industry. With jobs varying according to the type of sample being displayed, glue requirements are extremely changeable. Not only do machines apply an unusually even coat—one that most brush gluers could not match—but they handle hot and cold glues, resins, latex, and lacquers with equal ease.

The machines ordinarily take any pliable material up to ⅛ of an inch. However, when fitted with special cardboard attachments they can coat materials up to ⅜ of an inch thick. A thermostatically controlled electric heater beneath the glue tank assures proper working temperature for hot glues. Maintenance is an easy process comprised of end-of-shift cleaning of glue residue.

Along with their high volume of production and cost savings, the glue machines achieve a high rate of efficiency. "Our cards and books stand up under a lot of use," points out Richard Warsoff, the firm's vice-president. "We haven't had a complaint about one of them coming apart, yet."

Note: The type-Z gluers referred to in this article are manufactured by Potdevin Machine Co., Teterboro, N. J.

Operator feeds the title page of a textile sample book into a mechanical coater and gluer. A single machine and operator can outproduce six to eight brush gluers.

Edge-Gluing Wood Veneers

A Comprehensive Discussion of Factors Involved In Obtaining Strong and Attractive Glue Joints

Nearly all plywood produced is either three-ply or five-ply. However, whether three, five or more plies are used, all of them must first be made up to required width. In nearly every case, this involves gluing veneers together edgewise.

Veneers to be edge-glued—or "spliced"—must first be "jointed." This operation is a preliminary machining of perfectly straight edges. A high order of accuracy is necessary on such jointing to obtain really tight glue joints which are both strong and good looking.

Today, most wood veneers have their edges jointed either on continuous-feed machines which hold "books" of veneers on edge, or on large traveling-head jointers, such as those made by Merritt-Solem. The term "book" refers to a small pile of veneers, laid together and held tightly while being jointed.

Types of Jointers

Veneer jointers of the type which hold books on edge and travel them over cutterheads are quite dependable for stock six feet or less. However, in jointing veneers for making longer stock, the traveling-head machine is preferable because of the high degree of accuracy it affords.

On a machine of this type, veneers generally have both edges jointed. The usual procedure is to have them then go directly to the gluing or edge-joining operation as promptly as possible.

Two types of splicing machines are available for this operation. Some veneer-splicing machines travel veneers endwise while a joint is being made. They make use of some type of crowding device which forces the edges of veneers tightly together while the joint is being made.

In another type of unit, veneers proceed from the jointer directly to a so-called cross-feed veneer edge-gluing machine. Here, too, a crowding device is employed, but all travel of veneers is lateral.

When edge-jointed veneers proceed to the type of machine through which they are traveled longitudinally, for making one joint at a time, the necessary adhesive may be applied either at the veneer jointer, using a special attachment provided by the manufacturer, or glue may be spread on the edges at the veneer splicer. There are variations in practice.

Adhesive edge-splicing of wood veneers did not become practical until after the advent of heat-reactive resins. Heat is always used in one form or another where wood veneers are edge glued.

In the old days, the joining process involved using an adhesive tape on *surfaces* of adjoining veneers in the same operation in which edges were crowded tightly together. Glue could then be applied to veneer edges only *after* a preliminary taping operation of this kind.

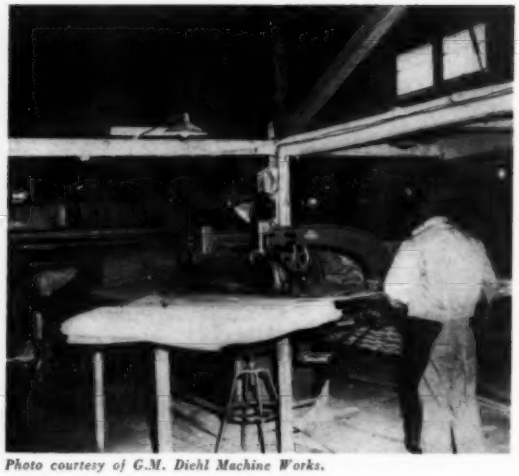
It was possible (though seldom practiced) to fold two jointed pieces of previously-taped veneer together —the tape acting as a hinge—apply glue to the two exposed edges, and fold them back until such time as the glue had set. This was a slow and costly process; so actual edge gluing was generally dispensed with.

In present-day practice, when edge-jointed veneers proceed from the jointer to a veneer-splicing machine of the type which processes them longitudinally, they may or may not be preliminarily spread with glue by an attachment at the veneer jointer. In some instances, glue is applied directly at the splicer itself. In these units an adhesive reservoir is provided under the splicer table infeed and an applicator places glue on the edges just before they are joined together.

One efficient longitudinal veneer-splicing machine is equipped with a

End view of a traveling-head veneer jointer shows cutterhead carriage, left, making the jointing cut on a book of veneers tightly held by the hydraulic clamp bar.

Photo courtesy of Solem Machine Co.



The longitudinal veneer splicer used at Elloree Veneer Co., Elloree, S.C., has convergent feed chains above and below, with heater bars between them.

Photo courtesy of G.M. Diehl Machine Works.

pair of endless feed chains, operating in a table at convenient working height, which are designed to carry the two veneers being joined. The two chains run slightly convergent, by this means pushing the two edges of two pieces of veneer tightly together as they proceed. The chains are far enough apart so that a lower heater bar can be provided in the table between them. This brings the heater bar into direct and tight contact with the under surfaces of the two veneers, directly at the joint.

Overhanging the two feed chains in the table is a pair of upper feed chains. These run convergent in like manner, and also have a heater bar positioned between them. The upper feed-chain and heater-bar assembly can be vertically adjusted as a unit. This makes it possible to exert sufficient pressure on sheets of veneer to engage them forcibly and carry them forward between the two heater bars. The adjustment also allows settings to be made for veneers of different thicknesses. A certain amount of knurling is present on contacting surfaces of the feed-chain links, allowing them to grip flat surfaces of the veneer effectively.

The heater bars are so close together that there is no chance for veneer edges to overlap. Nevertheless, the feed chains carry them positively through the machine, regardless of close contact of the heater bars. An operator sometimes requires a little experience before he can obtain the best possible setting of feed chains, as to tightness of their contact on veneer being processed.

On many of these machines, heater bars are brought up to desired temperature by means of an electrical resistance heating element. These elements can be replaced, at any time necessary. Each heating bar has a thermostat, which may be set so that thereafter the temperature is automatically controlled.

Some more modern machines, (these are particularly desirable where thicker veneers or even very thin lumber is being processed) incorporate electronic heating equipment, which swiftly heats through the greater thickness by the principle of molecular friction.

When glue is applied directly at a longitudinal splicer, a glue-applicator roller is employed at the front of the machine. This roller tapers from a knife-like edge at the rim to sufficient thickness toward its hub, so that necessary stability is provided.

The roller or wheel is located directly in line with the central feed fence of the splicer. In this way, the knife-like edge revolves between the two joining edges on pieces of veneer being fed into the machine. The lower part of the knife-edge roller runs in glue in the reservoir.

There are many cases, however, where adhesive is applied with a glue-spreading attachment on the veneer jointer, and where the bondant is allowed to dry on the edges before it comes to the splicer. In such instances, water is used in the reservoir at the splicer infeed, the lower portion of the applicator roll running in the water.

Just enough is carried into contact with the veneer edges to insure sufficient wetting of previously-applied glue. One definite advantage of this technique is that less glue is smeared either on the faces of veneers or on heater bars of the veneer-splicing machine.

When glue is applied at the veneer jointer, it is spread while all edges of the book of veneers are clamped tightly together. Consequently, no part of the liquid glue can get between the edges onto veneer faces. Moreover, since special adhesives, developed for veneer-splicer work, may often be allowed a relatively-long assembly period—possibly standing for an interval of from one hour to a couple of days before running through the veneer splicer—smearing characteristics of the adhesive have usually been eliminated by the time it reaches the splicing machine.

Heater bars on any veneer splicing machine must be inspected at regular intervals if liquid glue is being applied directly at the splicer. They must be kept clean. Excess glue on the bars may cause veneers to stick. Actual heat of the bars should also be checked quite regularly.

Sticking may, however, have other causes—sometimes, glue spread is too heavy; this will result in excessive squeeze-out. The greater deposit of glue on the bars in such a case will lead to sticking. Sometimes, when heater bars are maintained at too low a temperature, or too-fast feeding speed is employed, sticking will be experienced.

The Proper Adhesive

Success with veneer-splicing machines of this type depends in no small degree on use of the proper adhesive. Various glue manufacturers who have specialized in serving the plywood field have made a careful study of adhesives required for this operation.

As a result, so-called "splicer adhesives" have been made available by different manufacturers; some have provided two or three different adhesives for employment under varying splicer conditions. Frequently, such glues incorporate a special lubricant which greatly reduces their tendency to stick to heater bars.

Whenever it can consistently be done, high efficiency may be obtained by spreading glue directly with a special attachment such as that mounted on the Merritt-Solem veneer jointer. Here, the actual spreading operation is that of glue application to a relatively wide and flat surface—since several veneers are clamped together—using a ver-

tical-axis spreading roll to do the work.

Time is obviously saved by doing the work at this point, because glue is spread at the same pass in which the jointing is done. The spreading attachment used is highly ingenious, involving use of a so-called doctor disk for applying adhesive continually and uniformly to a vertical roll, which in turn transfers it to the veneer edges.

The doctor disk has its functional face in a vertical plane. It is so mounted that its lower portion runs through a glue reservoir, lifting adhesive continually and applying it to the vertical-axis roller. The vertical roll and the doctor disk are both carried on a special casting, which also incorporates the glue reservoir. This makes it possible to accurately govern the amount of adhesive applied to the roll, which in turn controls the spread on edges of the veneers.

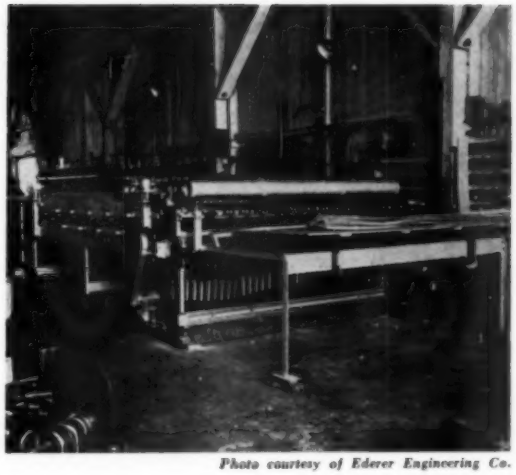
The entire attachment allows movement to and from the work, being pivoted for this purpose. The attachment travels along with the cutterheads, so the glue-application roll follows behind the cutterheads. As fast as the joint is made, adhesive is applied directly behind it. When travel of the carriage is reversed, however, the attachment moves out of contact with the table. Therefore, no adhesive is wasted, and none is allowed to foul the machine.

Excess Adhesive

On the two sides of the doctor disk, two round wipers are provided, which prevent any excess adhesive from being carried around and applied to the glue roll. Through an eccentric adjustment, these wipers may be placed closer to or farther from the glue roll.

Clearance between wipers and glue roll is usually held between .005" and .010". It is also possible to adjust pressure between the application roll and edges of the veneer. The attachment frame is pivoted for this purpose, and may be swung sensitively toward or away from the table by means of an adjusting screw provided.

Rotary drive for the glue-application roll is by means of chain and sprocket, but is obtained from a stationary rack. The chain and sprocket work together with a vertical shaft; this shaft is rotated by means of a spur gear. The spur gear meshes with a stationary rack which is attached to the frame of the machine.



View of the infeed of a cross-feed infrared veneer edge-gluing unit. This type of unit is often positioned directly behind the veneer jointer.

Photo courtesy of Ederer Engineering Co.

Thus, as the attachment is traversed the length of the machine, the gear, meshed with the stationary rack, is forced to revolve and to transmit that motion (indirectly) to the adhesive application roll. With an arrangement of this kind, surface speed of the roll is always and automatically in perfect time with linear carriage speed. The application roll is reconditioned by grinding from time to time, as it becomes worn.

The glue reservoir used with this attachment is equipped with a water chamber built into its bottom. When desired, an electric heating element can be inserted in the water chamber, thereby providing for application of hot glue. When cold adhesive is being run, however, the electric heating element is simply cut out of service.

In many instances where the veneer jointer is equipped with a glue spreading attachment, it works directly in conjunction with a cross-feed veneer splicer. This is an entirely different type of machine from those already considered. Such splicers feed successive pieces of veneer crosswise and exercise crowding action on them en route so that all edges are forced tightly together. Moreover, during traversal through the machine, the veneers are subjected to heat in one way or another.

Different types of cross-feed veneer splicers have been employed; some of the most modern are those which use infrared heat for curing the adhesive. Some of these units, such as those made by Ederer Engineering Company, have an initial infeed consisting of a number of parallel steel conveyor bands. Veneer pieces are placed in parallel across this gang of steel bands and are carried forward by them to a point where they run beneath a multiple V-belt crowding device.

V-belts on the crowding device travel at considerably greater speed than the steel bands. Therefore, as veneer pieces are carried into contact with the gang of V-belts, (having had their edges preliminarily spread with glue at the veneer jointer), they are slid forward over the gang of steel bands, and their edges are crowded tightly together.

During this edge-crowding interval, however, the pieces are passed between components which hold them perfectly straight and flat, so that no thicknesswise mismatching or overlapping can possibly occur. En route through the machine, while crowded tightly together, edge to edge, they are subjected to the infrared heat which cures the adhesive.

Infrared Heating Elements

Some units of this kind house ten infrared heating elements, each of which contains a sufficient number of tubes to provide the necessary degree of heat. Five of the ten heating elements are mounted above the conveyor line and five of them below; thus, heat is directed against both sides of the traveling veneer.

Two simple adjustments may be set for various veneer thicknesses. At the rear of the machine, automatic blower-type cooling units are mounted both over and under the output conveyor. These reduce the temperature of the veneer to the point where it can be handled conveniently.

▲ Adhesive is brushed on the bonding edge of a piece of urethane foam scrap and allowed to air-dry for five minutes.

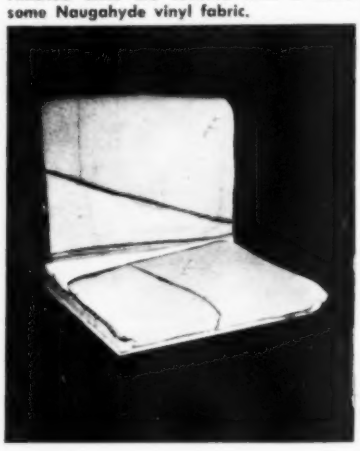
▲ Three segments of adhesive-spread urethane are spliced together to form a larger piece from which the cushion is cut.

▲ Mated pieces of urethane scrap which might otherwise be wasted are shaped into a recessed seat cushion.

▼ All the edges and the bottom of the cushion are brushed with adhesive and air-dried. The seat frame is also coated.

▼ The recessed foam cushion easily slips into the wooden frame and forms a weather-resistant bond.

▼ The bonded skeleton of a pilot chair. Finished units are covered with a handsome Naugahyde vinyl fabric.



Cushion manufacturer salvages remnants by . . .

Urethane-to-Urethane Bonding

To make possible a money-saving salvage factor in the production of cushioned boat seats, Coast Canvas Co., Toms River, N.J., needed a single adhesive capable of bonding urethane foam to itself and to wood.

Cushions for the "Perfect Pilot Seat" are made from both cut-to-size urethane foam and bonded remnants which might otherwise be wasted. In setting up for production, technicians called for an adhesive that would dry slowly enough to permit smooth operations, and fast enough to lose its tack once the pieces were mated in a soft, resilient seam.

Though several available adhesives for flexible foams could meet these requirements, the production problem at Coast Canvas was complicated by the fact that the same adhesive would have to bond the urethane cushion to a reinforced wooden seat frame.

Production and in-use requirements—such as weather and water resistance—were submitted to the company's adhesive supplier whose recommendations resulted in the step-by-step operation pictured here.

Note: The adhesive recommended for this operation was Bondmaster G472, manufactured Rubber & Asbestos Corp., Bloomfield, N.J.

Adhesives Bonding Reduces Costs and Permits New Design Concept

Adhesives vs. Brazing

Assembling metal parts such as small pinion gears to rotor shafts by adhesive bonding has advantages over fusion methods of metal joining. Adhesives do not require the high heat necessary for welding or brazing operations, which may distort the part or effect a change in the material hardness imparted by previous heat treatment. In many instances, adhesive bonding permits redesign of the part to eliminate additional assembly or production operations. Adhesives make it possible to join dissimilar metals with a minimum of bi-metallic corrosion. Because of these advantages, adhesive bonding often reduces costs by reducing rejects and secondary operations required with fusion methods of assembly.

Timing Gear Assembly

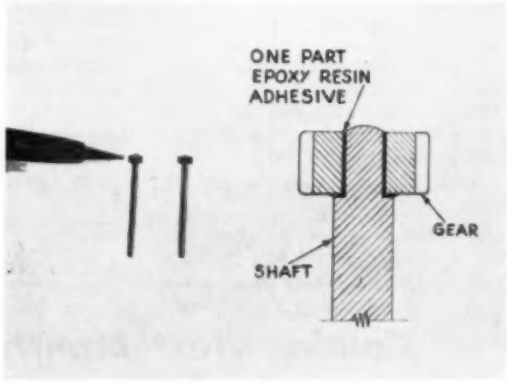
The Haydon Division, General Time Corp., Torrington, Conn., has realized these advantages in assembling timing gears by adhesive-bonding small pinion gears to rotor shafts. These timing gear assemblies are used in synchronous timing motors which require small gear trains of extreme accuracy. These gears, therefore, are accurately machined and heat treated to provide sufficient hardness for wear resistance.

The previous joining method consisted of brazing the pinion gears to the rotor shaft. This method, in many instances, distorted the gear configuration or effected metal hardness due to the high temperatures involved in brazing in addition to being a tedious and expensive labor operation. EC-1386, a one-part high-strength adhesive with an epoxy resin base, was selected by Haydon for this application.

This adhesive bonding method has provided savings amounting to $56.37 per thousand assemblies by: reducing rejects which were distorted by the previous high heat of brazing; permitting a part design modification to eliminate secondary operations required with the previous brazing method; and by eliminating the necessity for 100 per cent inspection for shaft distortion.

No adhesive bond failures of the timing gears occurred during laboratory life testing at high and low temperatures and at high humidity conditions.

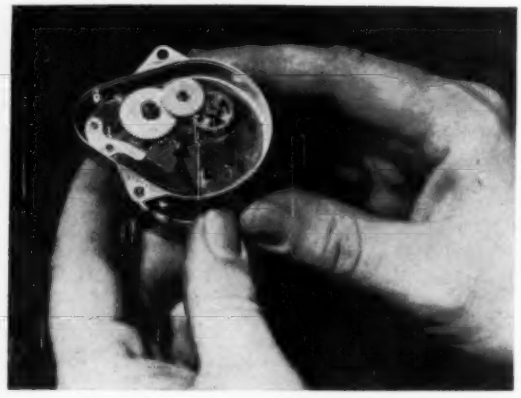
One-part epoxy adhesive EC-1386 has good flexibility and provides high strength bonds that have greater bending strength and greater resistance to cracking or shattering under shock or bend loads. This adhesive provides exceptionally high shear



Pinion gear and rotor shaft which are assembled by adhesive bonding with a one-part epoxy resin adhesive.

Applying adhesive to rotor shaft through hole in adhesive container.

Assembling pinion gear to adhesive coated rotor shaft by means of a foot press.



Gear train of synchronous timing motor meshes with adhesive bonded pinion gear, in the clutch motor.

strengths without the necessity of adding an accelerator or catalyst. Average shear strengths are in the range of 4670 psi at room temperature and 4630 psi at 180°F.

This 100 per cent non-volatile, liquid adhesive provides unlimited working life, a unique feature not available with other adhesives based on epoxy resins, and eliminates the difficulties some times associated with two-part epoxy resin adhesives such as short working life and the possibility of human error in mixing operations.

It is designed for metal bonding applications subjected to service temperatures of from minus 67°F, to plus 250°F. No volatile by-products are given off during the curing cycle which makes it particularly useful for bonding impervious surfaces.

The rotor shaft is first dipped in the EC-1386 adhesive through a control hole in a special adhesive applicator. This permits the application of the correct amount of adhesive to the shaft. Because the adhesive is a syrupy liquid and has a high viscosity in the uncured state, application of the adhesive to the shaft is a simple operation. The pinion gear is then pressed in place on the adhesive coated rotor shaft by means of a foot press.

Drying Procedure

The assembly is next placed on a drying rack which holds a large number of gear and shaft assemblies. The assemblies are then cured for one hour in an oven at a temperature of 350° F. The resulting bond after curing, yields shear strengths in excess of 4500 psi.

After the adhesive bonding operation has been completed, the gear and shaft are assembled through the timing motor bearings into the rotor cage by a hand arbor press.

Note: EC-1386 is a product of the Adhesives, Coatings and Sealers Division of the Minnesota Mining & Manufacturing Co., St. Paul, Minn.

Coming Next Month . . . .

Modification of Animal Glues—A discussion of the manner in which low cost glues can be upgraded to compare with higher strength, expensive glues by blending with trimethyl phenol.

Hot Spraying of Adhesives—How the hot spray process solved a difficult production problem.

Mosaic Tile/Steel/Styrofoam Curtain Walls—New rubber-resin adhesives and new application techniques bring new materials within the reach of architects and builders.

High Frequency

Curing of Adhesives

By Myron Kasok
Raybond Electronics, Inc.,
Newton, Mass.

Present and potential uses of high frequency or dielectric curing in the woodworking industry are infinite in scope. Edge-gluing, panel on frame construction, rim banding, veneering, leg post construction, structural lumber formations, finger-jointing, and panel construction with random length scrap stock are only a few of the many applications.

At the present time, high frequency curing is most widely used for edge-gluing—the formation of panels and cores from narrow width boards. In this application, users of dielectric equipment have found that the advantages of high frequency curing far surpass their expectations.

For example, one of the advantages of high frequency curing is that it makes possible a significant reduction in production personnel. As one user put it, "Where we formerly had six men doing the work on two machines, we have cut down to a man and a half per dielectric unit."

Another advantage of high frequency curing is that of decreased rejection of production items. In one case brought to the attention of the author, a failure which existed with the use of rotary clamps was reduced by 80 per cent upon the installation of a dielectric curing unit.

Still another area of savings is made possible by the urea formaldehyde glue used with high frequency curing equipment. In some cases the cost of urea resin over the animal glue used in most standard operations has resulted in savings of 60 per cent.

The increase in production following the introduction of high frequency equipment is an important contribution to plant economy. In almost every case where dielectric units have been installed, there has been a production rise of from 25-35 per cent.

Indirect Savings

In addition to the above, there are many indirect savings realized by the use of dielectric curing. Often, they are difficult to put into specific dollars and cents figures. For example, there is the matter of space savings.

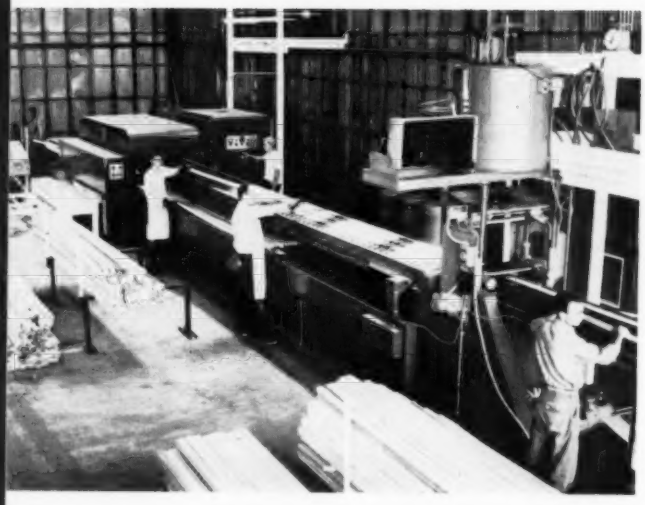
It is not necessary to store stock some 36 to 72 hours before final processing. Dielectric curing units will in most cases permit finishing within minutes or even seconds after ejection from the press. In addition, high frequency units take up considerably less floor space than comparative units of standard equipment.

Time saving is another important production bonus made possible with high frequency curing. In many cases, the latter results in a considerable reduction in unit production time.

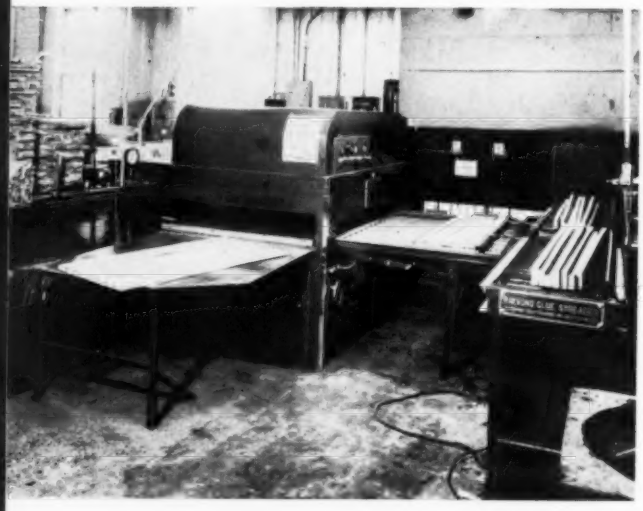
Probably the most important feature of high frequency curing is the quality production it affords. For example, it results in a marked increase

About the Author . . .

MYRON KASOK has worked on the design of a pneumatic press for use in conjunction with high frequency edge gluing. He is currently engaged in field engineering on practical applications of high frequency edge gluing equipment and in laboratory experimentation leading to new techniques and applications of high frequency energy. Mr. Kasok attended Tufts University where he studied mechanical engineering. He is presently studying electrical engineering at Northeastern University. He is a member of the Armed Forces Communications and Electronic Association.



Combination feed-through edge-gluer will provide a panel 52x100 inches. The unit has a production rate of approximately 60 panels an hour.



Panels 50x68 inches can be formed on this edge-gluer with a built-in ten-kilowatt generator. The gluing time for one-inch board is approximately 50 seconds.

Photo on the left shows a 30-kilowatt generator being used in conjunction with an hydraulic veneering press to cure molded plywood panels.

in glue line strength and appearance. This is due mainly to the rapid molecular motion within the glue itself during the exposure to radio frequency.

A furniture manufacturer recently told the author that during a local flood four carloads of furniture, the wooden parts of which had been glued up on electronic equipment, were under water for three days. In spite of this, not one case of glue line separation was discovered.

High frequency curing yields virtually indistinguishable glue lines and the problem of sunken joints, on a properly operating unit, is completely eliminated. This is due to the higher constant edge pressure during the complete curing cycle.

Reclaiming scrap lumber is another important "extra" made possible by high frequency curing. A core block assembly curing unit will permit the use of random length scrap strip which might otherwise go to waste. Panels formed from this operation may run upward of 50 to 100 inches.

Finger Jointing

Finger-jointing is another high frequency application by which millions of board feet of scrap may be utilized. A finger-joint curing oven with a 20-kilowatt generator averages a 12-second curing time with one-by-four stock moving through at a constant rate of 118 feet per minute. Such a unit will receive boards up to a maximum width of eight inches and a maximum thickness of two inches. When operated in conjunction with a high frequency edge-gluer, 50x120-inch panels may be formed from otherwise unusable materials.

Because of the many applications and the savings it offers, high frequency equipment is gaining increasingly wider acceptance in the woodworking industry. As time passes, many new applications for the process will be discovered.

The technique, however, should not be thought of as "something new." Dielectric curing units are now in operation throughout the United States, Canada and overseas. They are giving results and savings higher than any other gluing operation known to date.

The future of high frequency curing is boundless. In fact, because of the many applications permitting the use of scrap lumber, it is felt that this electronic technique is definitely one of the answers to our dwindling lumber supply.

1 Metal top of utility furniture item is spray coated with a thermoplastic adhesive. Automatic spraying systems can be installed if the volume warrants them.

2 The next step in the bonding operation is to spray coat the plastic laminate which will be joined to the previously prepared coated metal component.

Utility furniture manufacturer uses a pilot production run to find the best method for . . .

Bonding Plastic to Painted Steel

Four years ago, Simmons Company of Kenosha, Wisconsin, began looking into the best methods for applying a plastic laminate to painted steel in the manufacture of the firm's line of utility furniture. Production engineers wanted an adhesive and an adhesive technique that would both simplify operations by providing good initial contact strength and result in a cured bond capable of standing up to adverse temperatures and conditions over long periods.

It was pointed out that while the plastic laminate could be applied under controlled atmospheric conditions, the end-product was shipped in railway cars in which the temperature often went as low as −30°F. or as high as 130°F. Nevertheless, it was important that a finished furniture item arrive at its destination without any separation or creep between the steel and the laminate.

Simmons turned to its source of plastic laminates and found that about 30 adhesives had been tested for laminate-to-steel bonding. Of these, the one that exhibited the best all around characteristics for this application was D-253-20, a thermoplastic adhesive manufactured by the Armstrong Cork Company.

Armed with the test results, Simmons set up a pilot operation and began developing research specimens of laminate bonded to painted steel with the recommended product. The production line setup called for application of the adhesive by spray gun. An adhesive coating was applied to both the metal and plastic sheet.

Before proceeding to the actual joining of the parts, both the metal part and the laminate were briefly exposed to a bank of heat lamps. This step was introduced to speed production by helping to evaporate the adhesive solvent at a faster rate.

Once the parts had been mated, a roller exerting 30 pounds per square inch pressure was used to make the bond and assure firm contact between all areas of the two surfaces.

Simmons made up 24 sample tops and took them to a local deep freeze plant. Here the pilot specimens were subjected to a sub-freezing temperature of −25°F. The next day the same samples were exposed to a controlled heat of 110°F. Several samples were also sent to the firm's plastic laminates supplier. There, the panels were tested under extreme temperatures ranging from −40°F. to 100°F. and 100 per cent humidity. In all cases favorable results were reported.

To supplement these tests, Simmons took several furniture tops bonded with D-253-20 and placed them on the roof of a factory building. That was in September, 1955.

For the next three and a half years, the bonded units were exposed to rain, wind, sunshine, snow, smoke, and a variety of miscellaneous tortures. In January, 1959, the samples were examined to determine the strength of the bond. Considering the extreme exposure, they were in good condition; one showed no delamination at all.

As a result of the testing procedures described above, D-253-20 adhesive was specified as the company's standard production line bondant. To date, some 200,000 plastic laminate tops of various sizes

3 Prior to bonding the plastic laminates and metal tops together, both components are force-dryed in an infrared oven to speed production by quickly driving off excess solvent.

4 In assembling the components, a slip sheet is used to prevent premature contact.

have been satisfactorily bonded with it at the Simmons plant.

A thermoplastic synthetic rubber adhesive, D-253-20 has a metal-to-metal shear strength averaging 600 psi. Among its features are high initial strength and good resistance to heat, fatigue and creep. As has been shown, these qualities are of extreme importance in effecting a high strength plastic laminate-to-painted steel bond such as that required for the Simmons line of commercial and institutional furniture.

Though on the Simmons production line the adhesive application is by spray gun, D-253-20 can be applied by brush or roller coat. Where production volume warrants, the adhesive can be used in automatic spraying systems.

In most manufacturing operations, some sort of artificial heat is applied to force dry the adhesive and bond immediately under pressure. This technique has been found to be most efficient at Simmons. The adhesive can, however, be allowed to air dry for approximately ten minutes before pressure bonding. The choice of method used depends, of course, on local conditions and the production schedule for the entire operation.

For an operation such as the bonding of protective plastic laminates to painted steel, an elastomeric adhesive such as D-253-20 is particularly valuable in that it provides greater overall strength by allowing stresses to be distributed uniformly over the entire joint area. Thus, the adhesive plays an important part in absorbing the vibration and flexing of the unit and in accommodating movements at the glue line. The latter, incidentally are caused by differences in thermal expansion between materials as different as plastic laminate and painted steel.

Because the adhesive does not have to be cured before or after actual bonding, it was particularly valuable in the Simmons production setup. All jigs, clamps and flat-bed presses were eliminated and the laminated unit could be routed and shipped almost immediately.

5 Bonded tops are run through a pinch roll in a final assembly step. An instant and lasting bond is effected under this pressure and the unit is ready for immediate shipment.

NEWS of the ADHESIVES WORLD

New ASTM Committee On Joint Sealants Proposed to Assist Building Industry

A Steering Committee on Joint Sealants was called by the American Society for Testing Materials on June 10 in Philadelphia, Penna., for the purpose of discussing the formation of an active group on elastomeric joint sealants for the building industry. Douglas E. Parsons (National Bureau of Standards) was designated chairman of the Steering Committee. Representatives from various industries and ASTM committees attended the meeting. ASTM Committee D-1 on Paint, Varnish, Lacquer, and Related Products was represented by Harry Kelfer (Sterling Quality Products), who is chairman of D-1 Subcommittee 19 on Putty, Glazing and Caulking Compounds. J. R. Panek (Thiokol Chemical) represented ASTM Committee D-11 on Rubber and Rubber-Like Materials. Possible methods of placing such a group in the ASTM framework were recommended by Raymond E. Hess and Leroy C. Gilbert (ASTM Staff).

ASTM Committee Proposed

Action taken at the meeting consisted of a proposal that the formation of a new ASTM committee would best serve the industry and its needs; this committee to be known as Committee D-27 on Elastomeric Sealants. The scope of the new committee was defined as follows: "To develop test methods, classifications, nomenclature and performance specifications for elastomeric sealing materials for use by the construction industry for sealing joints. Typical sealants include elastomeric caulking and glazing compounds and preformed gaskets and tapes."

The Steering Committee named Wayne Koppes (Architectural Consultant) as president of the new committee, with R. K. Humke (Minnesota Mining & Manufacturing) as vice-president, and J. R. Panek (Thiokol Chemical) as secretary.

A list of manufacturers, users, interested parties, and associations involved in the use of joint sealants was supplied to ASTM. After indicated interest of this new committee becomes known, the Steering Committee will hold another meeting in the latter part of August. It is expected that the action at this August meeting will be the selection of a chairman for the polysulfide subcommittee, which will be involved in improving the performance specifications developed by the following three groups: Building Trades Specification Committee; Rubber and Plastic Adhesive and Sealant Manufacturers Council; and the National Association of Architectural Metal Manufacturers.

The Steering Committee announced that a contemplated meeting of the new Committee D-27 on Elastomeric Sealants is planned for the week of September 10 in Chicago, Ill.

Wayne Koppes (Architectural Consultant), president of the newly-suggested ASTM Committee D-27 on Elastomeric Sealants.

Sales and Earnings Up

Hooker Chemical Corp., Niagara Falls, N. Y., has announced that its sales increased 24 per cent while earnings increased 34 per cent, after taxes, in the first six months of the company's fiscal year ended May 31, compared with the like period of 1958. For the second quarter, the company showed a sales increase of 28 per cent and an earnings improvement of 42 per cent over the second quarter of 1958. Net sales for the 1959 six month period were $74,732,200, compared with $60,155,200 for the like period of 1958, and earnings of 93¢ per share of common stock compare with 69¢ in the 1958 period after income taxes of $7,645,000 and $4,493,500, respectively.

New Scotchcast Foam

A new silicone rubber foam which is said to have excellent adhesion to metals and plastics and cures at room temperatures, has been introduced by the Minnesota Mining and Manufacturing Co., St. Paul, Minn. Called Scotchcast brand foam resin No. XR-5017, the new foam-in-place resin possesses unusual adhesion to metals, glass and plastics without the use of a primer, bonding with such tenacity that the foam will rupture before its bond with these materials is broken, Minnesota Mining states. It also provides positive moisture protection because of a closed cell structure having negligible water absorption after 24 hours exposure at 90 per cent R. H. A two-part material, it can be foamed in place at room temperature or cured at 250°F. for a superior bond.

PCA Opens New Office

Pulp Chemicals Association has announced the opening of new offices at 60 East 42nd Street, New York, N. Y. Offices of the association were formerly located at 122 East 42nd Street in New York City. Through occupation of the new offices, the association expects to better serve the needs of a growing industry of producers of chemicals derived from the black liquor skimming and other by-products of the southern (kraft) pulp manufacturing industry. The association represents manufacturers of chemical products produced by, or from products of the wood pulp industry, and its program is designed to sponsor and encourage research in production and marketing, to collect, compile and disseminate industry statistics, and to direct public relation efforts for the industry.

To Pay Stock Dividend

Directors of the American-Marietta Co., Seattle, Wash., have authorized a five-for-four split of the common stock to be effected in the form of a stock dividend. The directors also plan to continue the 25¢ quarterly cash dividend on the increased shares outstanding starting with the November 1 distribution, in view of the rise in earnings this year. The board voted the regular quarterly cash dividend of 25¢ for payment to common stockholders on August 1. In connection with the stock split, the company said distribution of one additional share for each four held would also be made on August 1.

Mortimer P. Schester

Joins National Starch

Mortimer P. Schester, formerly president of Polytex Adhesives Corp., has joined the market development staff of National Starch & Chemical Corp., New York, N. Y. According to National Starch, it will continue the operation of the Polytex facilities at Wallington, N. J., where an expanded line of adhesives, coatings and related products will be manufactured. Mr. Schester is a graduate of the University of Chicago with a degree in chemical engineering. He has been active in the latex and rubber adhesive fields for more than 17 years, including several years as plant manager at the Flintkote plant in Whippany, N. J., and he has had experience in both the development and field application of products of these types.

Avery Elects Torrey

John S. Torrey, general manager of the Avery Label Co., Monrovia, Calif., has been elected vice-president of Avery Adhesives Products Co. Mr. Torrey, who joined the firm as general sales manager in 1948, heads up all facets of Avery's Label Division, including production at Monrovia and New Brunswick, N. J., and sales facilities in 26 cities.

Buys Concrete Firm

American-Marietta Co., Seattle, Wash., has announced that it has acquired the Marietta Concrete Corp., Marietta, Ohio. According to American-Marietta, the Ohio company produces concrete storage silos, bins and precast structural components.

Detects Water Leaks

Office of Technical Services, United States Department of Commerce has announced that a new paste has been formulated by Navy researchers which detects leaks in pressure vessels up to 500°F. According to the Office, the paste, when in contact with cold or hot water, reacts with a clearly seen, permanent color change. The coating is adherent but easily removed by wire brushing, and it is easily applied and noncorrosive, the office states. The formula has equal parts of silver chromate and lead chloride mixed with enough thinned, phenolic base spar varnish to give a smooth paste of desired consistency. Tests showed the paste to be virtually unaffected in its water indicating properties by 300 hours at 500°F. or 300 hours at 100 per cent relative humidity.

Packaging Conference

The Division of Adult Education, Purdue University, Lafayette, Ind., has announced that a two day conference on Packaging Specification will be held on the campus on October 5 and 6. According to the announcement, experts will discuss various aspects of this subject and give illustrations of actual specifications. Consideration will be given to the points of view of transportation companies, the military, package manufacturers, and principally, the users of containers. The conference will be coordinated by Charles J. Zusi, nationally known packaging consultant. Further information can be obtained from Mark E. Ocker, Division of Adult Education, Memorial Center, Purdue University, Lafayette, Ind.

Furniture's Best Year

A 12 per cent increase in volume of sales at the furniture manufacturer level was predicted for 1959 by John M. Snow, executive vice-president of the National Association of Furniture Manufacturers. Speaking at the opening of the summer furniture market at the Merchandise Mart, Chicago, Ill., Mr. Snow said that the NAFM estimate for manufacturer sales for 1959 is $2,600,000,000 as compared with $2,316,000,000, the 1958 volume. He reported that NAFM envisions a continued and gradual climb upward until late 1960, then a leveling off with possibilities of a mild recession, and then upward again.

Five Papers Read At Adhesion Conference

A one-day Conference on Adhesion, sponsored by the London Sections of the Plastics Institute and the Institution of Rubber Chemistry, was held on April 17 in William Beveridge Hall at London University, London, England. Five papers were read which covered some theoretical and applied aspects of adhesions. Abstracts of the five papers follow:

Physical Aspects of Adhesion. **N. A. De Bruyne (Ciba [A.R.L.] Ltd).** This introductory paper discussed the extent to which "classical" physics can explain the phenomena of adhesion. It was illustrated by demonstrations and a short film.

Surface Chemistry and Adhesion of Polymers. **W. C. Wake (Research Association of British Rubber Manufacturers).** The nature of the interface and the concept of surface free energy were outlined and surfaces of high and low energy discussed. After considering physical adsorption, speculation on the possible role of chemisorption in particular cases is commented on. The adhesion of flexible polymers such as rubber and PVC to textiles is of particular industrial importance. The influence of the form of the textile and the need to use specific adhesives concluded the lecture.

Synthetic Melt Adhesives. **L. E. Puddefoot (B. B. Chemical Co. Ltd.).** A characteristic property of melt adhesives is an extremely short setting time. Even when the substrata have smooth impermeable surfaces (e.g. polyethylene) the interval between application of fluid adhesive and attainment of adequate working bond strength may be reduced to a fraction of a second by accurate control of temperature and extrusion speed of a properly formulated adhesive. To take full advantage of this property, high speed thermostatically controlled applicators are necessary and must usually be designed to work in conjunction with high speed forming and assembling machinery. This principle was illustrated by reference to adhesives and corresponding applications as used in shoe manufacture and in the packaging industry.

The Assessment of Bond Quality in Glued Wood Joints. **R. A. G. Knight (Forest Products Research Association).** The paper dealt with the nature of the adherend, the principal forms of glued wood joints, standard tests for adhesives as such and for the bond quality in a wood/glue composite. Relative merits of assessment by mechanical tests and by the appearance of the interface were compared.

The Relation of Physical Testing to the Use and Characteristics of Pressure Sensitive Adhesive Production. **J. F. Millard (Johnson & Johnson [Great Britain] Ltd.)** The desirable properties of pressure sensitive adhesive products were defined and classified. These properties relate to the usefulness of the product in its end application and test methods in current use are essentially attempts to define these properties, or particular aspects of them in reproducible quantitative terms. Individual test methods were reviewed in this light, with particular reference to officially specified tests, suggestions being made to cover properties not at present specified.

Special emphasis was placed on properties which are strictly properties of the adhesive or the adhesive/backing system and which are common to the major groups of products. Reference was also made to the more important aspects of certain specialized products. Collaborative investigation into adhesion testing made by the Adhesive Tape Manufacturers Association was reported in this interesting paper.

Betham Erecting New Annex

The Betham Corp., Middlesex, N. J., has announced that it is erecting a new annex to house the additional production equipment demanded by the expanded adhesives markets served by the company. According to reports, the new building adds an additional 75 per cent to the space of the original installation. The Betham Corp. has specialized in the custom-coating of specialty pressure sensitive products since its inception in 1953.

Campbell Appointed

Douglas E. Campbell was appointed secretary-treasurer of the Pulp Chemicals Association, at a meeting of the Executive Committee of the Association on June 23, succeeding Dernell Every who has resigned. Mr. Campbell has broad experience in the chemical industry, having worked with the Manufacturing Chemists' Association as assistant to the secretary; National Aniline Division, Allied Chemical Corp.; Merck & Co.; and the Denver Chemical Manufacturing Co. He holds a B.S. degree in chemistry from the University of Michigan and an L.L.B from New York University.

Seven TAPPI Grants

The Research Appropriations Committee of the Technical Association of the Pulp and Paper Industry, New York, N. Y., has announced seven new research grants in the TAPPI research program. The grants were distributed among five technical committees of TAPPI. The Wood Chemistry Committee and the Graphic Arts Committee each received two grants; the other grants were awarded to the Paper and Paperboard Testing Group, the Coating Committee, and the Fluid Mechanics Committee.

Settle Patent Dispute

Minnesota Mining & Manufacturing Co. and General Plywood Corp. have announced settlement out of court of a two year controversy involving patents for finishing wood. The agreement clears the way for licensing of a General Plywood process. According to the joint announcement, Minnesota Mining agreed to give up its patent and further challenges to General Plywood's patent. No money was involved and General Plywood agreed to forego claims for damages. The patents involved a method of producing a smooth finish on wood, especially sheets of such materials as plywood. General Plywood's patent covers a process for feeding the wood through a series of rollers. The resulting pressure heats the natural resins in the wood, called lignin, which then melt and fill the porous surface. It is claimed that this eliminated sanding and various finish coatings to prepare the wood for painting or other treatment.

Staley Buys U B S

Stockholders of U B S Chemical Corp., Cambridge, Mass., have authorized the acquisition of U B S by the A. E. Staley Manufacturing Co., Decatur, Ill., through the exchange of 1¾ shares of U B S for each Staley share. Acquisition of U B S is expected to add impetus to Staley's research and polymer chemicals and to aid in the growth and diversification of its product line. Initially, U B S will continue to operate as an autonomous unit with Paul W. Atwood continuing as its president. In the Staley expansion program, research activities have been tripled in the last four years and the company recently broke ground for the construction of a new research center in Decatur, Ill.

Branch Sales Office

Emerson & Cuming, Inc., Canton, Mass., has announced the establishment of a branch sales office to cover Metropolitan New York and the Long Island area. The office is located at 52 Elm St., Huntington, L.I., N.Y. Ray L. Johnson will be in charge of the office. Mr. Johnson, who was previously in sales with Dumont and Telectronics, is a graduate engineer from Newark College of Engineering. He has over ten years experience in engineering and sales work.

Antara Price Reduction

Antara Chemicals Sales Division of the General Aniline and Film Corp., New York, N.Y., has announced a 40 per cent price reduction on the new solid grade of polyvinyl pyrrolidone, designated PVP K-90. The material is now available at $1.80 per pound in C/L or Tr/L drum quantities. PVP K-90 has an average molecular weight of 360,000. This solid, high-viscosity grade of PVP is said to have advantages over other polymers in many applications, particularly where strong film strength is required and in non-aqueous systems. It is of special interest to manufacturers of adhesives, synthetic fibers, waxes and polishes, cosmetics and coated papers. Antara will continue to supply PVP K-90 also as a 20 per cent aqueous solution.

New Coating Machine

New Rochelle Coating Corp., New Rochelle, N.Y., has designed, erected and installed a pressure-sensitive coating machine, said to be one of the largest ever built, in its plant at New Rochelle. In a single continuous operation, the new machine, which is 80 feet long, applies an adhesive coating, then dries, laminates, slits, and winds the web, the company reports. Its 62 inch web width is enough to permit continuous production runs of extremely large pieces such as pressure-sensitive display posters and advertising signs, or of small pieces in large volume, the company states. New Rochelle claims that among the materials the machine can process in volume quantities are vinyl, acetate, oilcloth, oilsilk, Mylar, polyurethane foam and film, metal foil and paper.

Flame Resistant Resin

Celanese Corp. of America, New York, N.Y., has announced that its Plastics Division has added a flame resistant resin to its Fortiflex A series of linear polyolefin plastic materials. The company reports that the resin is available in melt indexes of .7, 2.5 and 5.0, in natural color and black.

Have a Problem?

An adhesives problem, that is. If so, send it along to our Consultant's Corner. See pages 8 and 9, this issue.

Formica Names Four

Formica Corp., Cincinnati, Ohio, a subsidiary of American Cyanamid Co., has announced that William F. Drees has been named vice-president. Succeeding Mr. Drees as flakeboard and special products manager in Cincinnati is Charles G. Reiter, former manager of Formica's north central region. B. R. Allen, Chicago district sales office manager, has been appointed north central regional manager, and Mark E. Bloch succeeds him as manager of the Chicago sales office. According to Formica, the four appointees form a new research and planning group which will work on long range product planning, product research and development, new product applications, market analysis and research, sales pioneering of new products, and the possible acquisition of new products and processes.

Appoints Distributor

Minerals & Chemicals Corporation of America, Menlo Park, N.J., has appointed Van Horn, Metz & Co., Inc., New Kensington, Penna., as distributor for its complete line of inert minerals. The new distributor will maintain warehouse stocks of Minerals & Chemicals products, which include aluminum silicate pigments and Attapulgus clays widely used in the manufacture of adhesives, paints, plastics, inks, rubber, fertilizers and other chemical materials, at the suburban Pittsburgh location to serve customers in western Pennsylvania and northern West Virginia. In addition, Van Horn, Metz will also distribute M&C products from its main office in Conshohocken, Penna., and from other branch offices and warehouses in Baltimore, Md., and Richmond, Va.

Files with S.E.C.

U. S. Plywood Corp., New York, N.Y., has put a proposed public offering of $15 million of 20 year subordinated debentures into registration with the Securities and Exchange Commission. The debentures are to be convertible into common stock until July 1, 1969. Underwriters for the offering will be headed by Eastman Dillon, Union Securities & Co. U. S. Plywood plans to apply the proceeds to the acquisition cost of the Booth Kelly Lumber Co. of Springfield, Ore.

Growth of Adhesives

The June issue of the *Battelle Technical Review*, published by the Battelle Memorial Institute, Columbus, Ohio, features an article by Charles W. Cooper and Herbert N. Johnson which describes the growth trend and future applications for adhesives. The two adhesive research specialists at Battelle report that the adhesives industry is one of phenomenal growth and, as such, represents an area of relatively good customer acceptance of new materials and methods. While new and unusual uses of adhesives will contribute much to future growth of the industry, Messrs. Cooper and Johnson concede that much of the growth to date has resulted from "more mundane, less noticed" uses of adhesives.

Looking at future demands for adhesives, the Battelle specialists foresee increased use of adhesives in curtain wall construction; in marine assembly, and in the production of automobiles, trailers, scientific instruments, cameras, optical equipment, duct work, and appliances. According to Messrs. Cooper and Johnson, the improvement in the strengths of adhesives has made them available for use in application formerly closed to such materials. The authors envision adhesives with greater specificity, improved resistance to high temperatures, weathering, water, solvents, oils and greases. With the properties now available and under development almost every product can in some measure be adapted—and probably advantageously—to adhesive bonding, they state.

Borden Names Matzen

Borden Chemical Co., New York, N.Y., has announced the appointment of Charles A. Matzen, Jr., as a West Coast sales representative for its Consumer Products Department. According to Borden, Mr. Matzen will be responsible for the sales of its full line of adhesives for the home handyman, vinyl garden hoses and sprinklers, and ureaform fertilizer in northern California, Nevada, and Utah. Mr. Matzen graduated from San Francisco State College with an A.B. degree in liberal arts. In recent years, he has served as athletic director of the Columbia Park Boys' Club in San Francisco, and as recreation supervisor of the San Rafael, Calif., Recreation & Park Department. He formerly was a pitcher with the Pittsburgh Pirates baseball organization.

Peter D. Shroff

Narmco Names Shroff

Narmco Resins & Coatings Co., Costa Mesa, Calif., has appointed Dr. Peter D. Shroff to the newly-created post of manager of product engineering. Dr. Shroff will direct the activities of the Product Engineering Department at Narmco, and his responsibilities will include the development of new products, as well as the modification of existing, field proven products. In addition, his department will embrace the Technical Service Section, which will provide the facilities and support for product testing, the company states.

Dr. Shroff received his B.S. degree from the University of Bombay, his M.S. degree from the Royal Institute of Science in London, and his M.S. and Ph.D. in chemical engineering from Michigan State University. He has been senior development engineer with General Electric Co., and engineer in charge, pilot plant, for Bauer and Black. Prior to joining Narmco, Dr. Shroff was manager of products development for Fluor Products Co.

Cyanamid Urea Plant

Cyanamid of Canada, Ltd., has announced that it is building a urea and anhydrous ammonia plant in Hamilton, Ont., Canada. According to the company, the new plant, located near the steel plant of Dominion Foundries & Steel Ltd., will use gases recovered from the steel mill from which urea and anhydrous ammonia will be produced. Cyanamid reports that the plant will have a rated capacity of 66,000 tons of urea and 52,000 tons of anhydrous ammonia. The bulk of ammonia output will be further processed into urea, the company states.

Keener Addresses AMA

At a recent meeting of the American Marketing Association in Cleveland, Ohio, J. Ward Keener, president of the B. F. Goodrich Co., stated that "today's tots, teenagers and newlyweds will have at least three times as much to spend on the "niceties of life" in 1970 as do their parents today. Americans in general are expected to have nearly half-again as much 'disposable income' by that time." Mr. Keener said that this predicted surge in spending foretells a "revolution in technology, in production and in marketing."

Mr. Keener, a one-time professor of economics at Ohio Wesleyan and self-style "practitioner of sorts in the field of market research", bases his estimate on a number of factors, including (1) A predicted population rise of 40,000,000 over the 1957 figure of 171,000,000. (2) The fact that "the average individual's presumed needs and wants will be considerably higher than today because of the average higher level of education." (3) An estimated gross national product of about $650 billion "in constant 1957 dollars." (4) An increase in disposable income by 1970 of about 45 per cent. (5) The fact that "the great proportion of the 45 per cent increase in real disposable consumer income will go to the primary group of income producing people between the ages of 20 and 59."

Schoch Awarded Medal

Dr. Thomas J. Schoch, supervisor of basic starch chemistry at the George M. Moffett Research Laboratories of Corn Products Co., Argo, Ill., has been awarded the Saare Medal for his pioneering research in the field of starch and starch fractions. He received the medal during the 1959 Starch Congress held recently in Detmold, Germany. Presentation of the Saare Medal was made by L. Altrogge, president of the Association of Cereal Research, before several hundred carbohydrate chemists and starch technologists from all parts of Europe. The Saare Medal, named in honor of Prof. Dr., Oskar Saare, founder of modern starch research in Germany, is awarded each year to a man who has made outstanding achievements in the field of starch research. The selection is made by the executive committee of the Association of Cereal Research.

GEORGE MEANY — *Portrait by Fabian Bachrach*

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GEORGE MEANY, ***President American Federation of Labor–Congress of Industrial Organization***

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ADHESIVES AGE

Form Resin Committee

Organization of a Resins Committee in the Packaging Institute was assured as the result of an exploratory meeting held recently in Chicago under the auspices of the Materials Division of the Packaging Institute. A formal organizational meeting, with election of permanent officers, is to be held prior to the Packaging Institute's Annual Forum on November 16-18, in New York City. Nineteen specialists from various phases of industry who attended the initial meeting agreed that the over-all objective of a resins committee would be: "To establish basic criteria on resin materials to benefit the packager. This would be accomplished through the cooperation of the packager, converter, raw materials supplier and machinery supplier." The meeting also included the designation of officers *pro tem*. They are: *Chairman*, Ross C. Reed (Dobeckmum) and *Secretary*, Philip Johnson (Pepperell Mfg.). Further information on the November meeting, committee membership and future activities may be obtained from Mr. Reed, at 3301 Monroe Ave., Cleveland 13, Ohio.

3M Promotes Selden

Minnesota Mining & Manufacturing Co., St. Paul, Minn., has announced the promotion of J. W. Selden to general manager of its Chemical Division. Mr. Selden succeeds Dr. B. J. Oakes, 3M vice-president who has retired after 31 years with the company. A graduate of Pennsylvania State University, Mr. Selden has been with the company since 1948. He has been assistant general manager of the division since 1955. Dr. Oakes joined the company in 1928 as chief chemist. He became general manager of the Chemical Division when it was formed in 1955 and was elected a vice-president in 1957.

Reichhold To Buy Firm

Reichhold Chemicals, Inc., White Plains, N.Y., has announced its intention to purchase Alkydol Laboratories, Inc., Chicago, Ill. The acquisition will give Reichhold its second plant in the Chicago area and its seventeenth in the United States. Alkydol Laboratories manufactures a wide range of synthetic resins including alkyds, hard polyester coating resins, epoxy and other resins for surface coatings, adhesives, paper, plastic and allied industries. Terms of the transaction were not announced.

No. 5 of a Series

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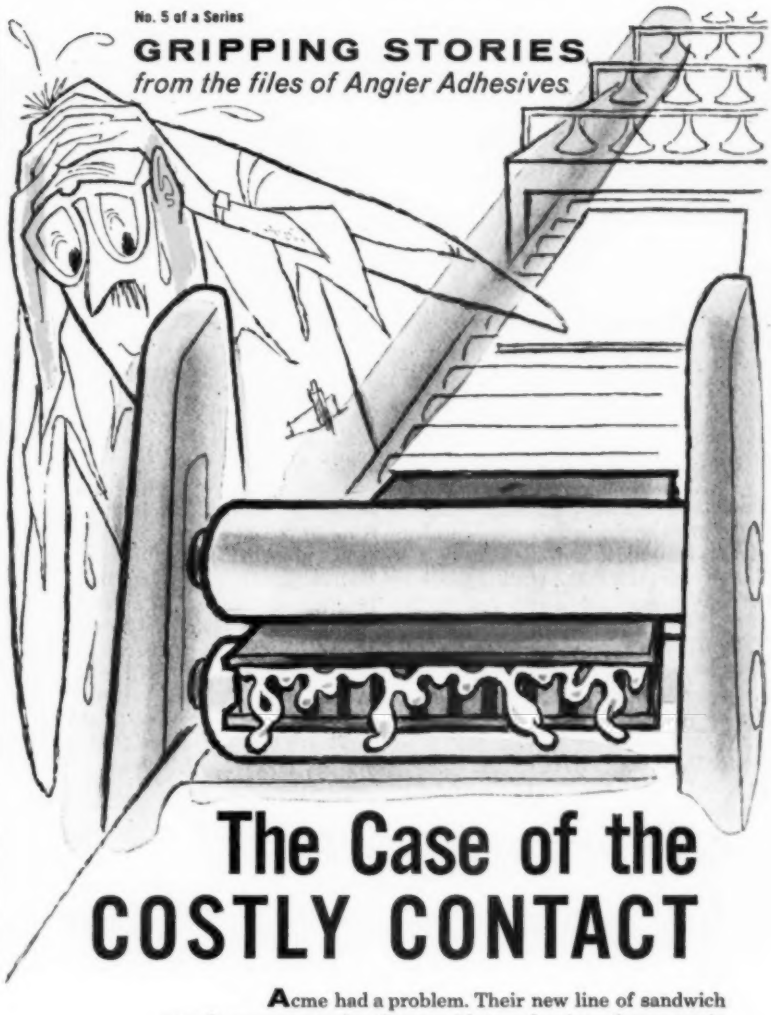
from the files of Angier Adhesives



The Case of the COSTLY CONTACT

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names in the news

Herbert A. Goeden, chief of manufacturing service for the Conolite Plastic Laminate Department of the Flexible Packaging Division of Continental Can Co., has been elected president of the Milwaukee Section of the Society of Plastics Engineers.

Kenneth W. Rieck, formerly with U.S. Forest Products Lab., has joined Minnesota Mining & Manufacturing Co., as a chemist in duplicating products.

P. W. Wright, director and secretary of Shawinigan Chemicals, Montreal, has been appointed vice-president of the company.

James R. Biles has been named manager of the Micarta Division of United States Plywood Corp.

John-Basil Yannas has joined the Dewey & Almy Chemical Division, W. R. Grace & Co., as a chemist in the organic chemical research laboratory at Cambridge, Mass.

F. L. Scott has been appointed technical manager for the Organic Coatings Division of Metal & Thermit Corp.

Judson W. Arnold has been named to the newly created post of director of development at Shawinigan Resins Corp.

Herbert E. Hirschland has been elected vice-president in charge of commercial development for Metal & Thermit, and **Donald R. Meserve** has been named sales manager of the Organic Coatings Division.

Lucille Lightfoot has been named head of product quality control for the Packaging Corp. of America.

A. Donald Herbert has been appointed product line manager for the Scientific and Process Instruments Division of Beckman Instruments.

E. L. Barkley has been named product sales manager for synthetic resin chemicals by Heyden Newport Chemical Corp.

William F. Mitchell, general manager of the Chemical Division of General Mills, has been elected a vice-president of the company. **John Chadwick** has been named San Francisco sales representative for the Chemical Division.

Robert P. Craver has been named manager of the Bainbridge, N. Y. casein plant of Borden Chemical Co., and **Robert J. Dunn** has been appointed manager of the resin and formaldehyde plant in Bainbridge. **Harry Myers** has transferred from the Chicago district office to the Polyco - Monomer Department of Borden Chemical to Dallas as technical sales representative. **Alvin E. Jerome** succeeds Mr. Myers in Chicago.

Raymond A. Hauck, Burton L. Appleton, Roger Z. Burde and A. N. Moyer have joined the Central Research Laboratories of Armour & Co. **Marvin Schram** has joined Armour Chemical Division as southeastern sales representative at Charlotte, N. C.

Paul I. Roth has been promoted to group supervisor of applied research at Minnesota Mining & Mfg., while **John C. Holmes** has been named sales representative to the textile and leather industries on the West Coast.

Robert F. Curran, formerly with Shawinigan Resins, has joined Ott Chemical as plant engineer.

Henry B. Puff has been named assistant product manager, resins, for the Durez Plastics Division of Hooker Chemical Corp. **Edwin E. Woodman** has been appointed Chicago district sales manager, succeeding Mr. Puff, and **William J. Parmley** has been named works manager of the division's Kenton, Ohio plant.

Carl G. Schwarzer has joined the Plastics and Resins Division of Shell Chemical Co., and **Robert W. Martin** has been appointed head of the Thermoplastics Department at the company's Emeryville Research Center.

John E. Warner

Portrait Of

JOHN E. WARNER

Mr. Warner's current assignment at The Goodyear Tire and Rubber Company is manager of the Coatings Department of the Chemical Division. One of the original members of the ADHESIVES AGE Editorial Advisory Board, he is a graduate of Kent State University, Ohio, and holds a Bachelor of Science degree in chemistry.

Joining Goodyear in 1948, Mr. Warner was assigned to the company's training squadron and subsequently became a member of the research and development laboratories. In 1949, he was transferred to Goodyear's Chemical Division and, after preliminary training in Akron, accepted a field assignment as special representative in the Division's Chicago office. Named district manager of the Chemical Division's St. Louis area in 1952, he remained in that capacity until his present assignment as head of the Division's Coatings Department.

John Warner is a member of various technical organizations such as the American Chemical Society, the Technical Association of the Pulp and Paper Industry and the National Paint, Varnish and Lacquer Association.

A Navy veteran who served on destroyers in the South Pacific during World War II, Mr. Warner is the father of two boys, eight and five. He and his family live just outside the city limits of Akron.

Named Representative

John Chadwick has been appointed San Francisco sales representative for the Chemical Division of General Mills, Minneapolis, Minn. His headquarters will be at the division's sales office at 116 New Montgomery Street, San Francisco. Mr. Chadwick received a B.S. degree in chemistry at Marshall College and then served three years with the U. S. Army. He joined General Mills in December, 1958. He had been a trainee in the division's Technical Service Department in Kankakee, Ill. In his new post, Mr. Chadwick will be responsible for sales of Versamid polyamide resins, Genamid epoxy curing agents, fatty nitrogen chemicals, and other specialty chemical products in the San Francisco, northern California, Oregon and Washington areas.

Appointed Controller

Eugene J. Northacker has been promoted to controller of the Corn Products Co., New York, N.Y. Mr. Northacker, who had been controller of Best Foods, Inc., before it was merged with Corn Products last fall, will report to Howard C. Harder, financial vice-president of Corn products.

OTS Issues Two Reports

Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C., has issued two new reports, the first of which is entitled *Development and Evaluation of Waterproof Two-Way Stretch Laminated Fabrics,* by R. Briganti and P. Sylvia, Jr. (U. S. Navy Clothing and Textile Office). This report describes a newly developed two-way stretch, waterproof fabric which is reportedly suitable for swim or rescue suits in cold-water areas. Designated Order PB 151034, the 22 page volume was published in April, 1958, and is priced at 75¢.

Staley Miralloid Gums

A. E. Staley Manufacturing Co., Decatur, Ill., is now marketing a series of gums which are produced by the acetylization of corn starch. The Miralloid type may be used to slash cotton, woolen and worsted yarns or blends of these fibers with synthetic fibers. According to Staley, they cook quickly to form solutions of stable viscosity that are resistant to reheating and aging. Sizes made from the gums are said to work well at various homogenizer pressures and have excellent all-round working properties.

Borden Earnings Up

Borden Co. has announced that its earnings for the first quarter of 1959 were up 7.4 per cent over the same period in 1958. Earnings amounted to $4,525,822, or 94¢ a share, compared to $4,213,057, or 87¢ a share, for the first quarter of 1958. First quarter sales totaled $220,644,746, up about three quarters of one per cent from the 1958 figure of $218,975,212. Provision for Federal income taxes was $4,348,349, compared to $4,048,023 for the same period of 1958. The company also announced that the board of directors declared a dividend of 60¢ payable June 1, to stockholders of record May 8.

Marketing Symposium

The National Flexible Packaging Association, Cleveland, Ohio, sponsored a Market for Profit Symposium on June 15-17, at the Kellogg Center for Continuing Education, Michigan State University, East Lansing, Mich. "Products and Markets" was the subject discussed at the June 15 session; "Price Policy" at the June 16 meeting; and "People in Selling" at the June 17 session.

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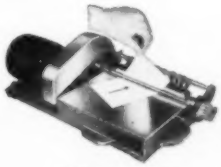

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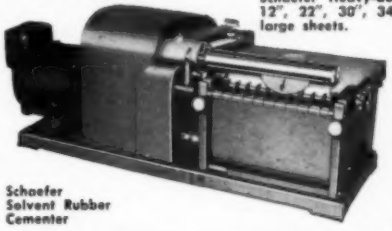

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Aug. 18-21. 10th TAPPI Testing Conference, Multnomah Hotel, Portland, Ore.

Aug. 29-Sept. 1. National Association of Furniture Manufacturers Supply Equipment and Fabric Fair, Conrad Hilton Hotel, Chicago, Ill.

Aug. 31-Sept. 4. Gordon Research Conference, Chemistry of Adhesion, New Hampton School, New Hampton, N.H.

Sept. 9-11. TAPPI Symposium on the Fundamentals of Fiber Attraction and Bonding, Institute of Paper Chemistry, Appleton, Wisc.

Sept. 10-11. ASME Wood Industries Conference, Multnomah Hotel, Portland, Ore.

Sept. 21-23. TAPPI 14th Plastics-Paper Conference, Edgewater Beach Hotel, Chicago, Ill.

Sept. 21-25. 14th Annual Instrument Automation Conference and Exhibit, International Amphitheater, Chicago, Ill.

Sept. 21-25. 1959 Congress on the International Council for Building Research, Studies and Documentation, Rotterdam, Holland.

Sept. 27-29. National Fibre Can & Tube Assn., Semi-Annual Meeting, The Broadmoor, Colorado Springs, Colo.

Sept. 27-30. American Institute of Chemical Engineers, St. Paul, Minn.

Sept. 28-30. American Oil Chemists' Society, Hotel Statler, Los Angeles, Calif.

Sept. 28-Oct. 2. 14th Annual Hardware Show, New York Coliseum, New York, N.Y.

Oct. 5-6. Conference on Packaging Specifications, Purdue University, Lafayette, Ind.

Oct. 6-8. National Hardwood Lumber Association, Queen Elizabeth Hotel, Montreal, Canada.

Oct. 6-9. 2nd International Symposium on "High Temperature Technology" sponsored by Stanford Research Institute, Asilomar, Calif.

Oct. 7. Society of Plastics Engineers, Cleveland Section, Cleveland, Ohio.

Oct. 11-16. ASTM 3rd Pacific Area National Meeting, Sheraton-Palace Hotel, San Francisco, Calif.

Oct. 13-14. National Technical Conference, Society of Plastics Engineers, Ambassador Hotel, Los Angeles, Calif.

Oct. 18-22. The Electrochemical Society, Inc., Deshler-Hilton Hotel, Columbus, Ohio.

Oct. 19-21. National Paint, Varnish & Lacquer Association, Chalfonte-Haddon Hall, Atlantic City, N.J.

Oct. 19-23. 47th National Safety Congress and Exposition, Conrad Hilton Hotel, Chicago, Ill.

Oct. 20-24. 24th Paint Industries' Show, Convention Hall, Atlantic City, N.J.

Nov. 12-14. National Association of Lumber Manufacturers, Annual Meeting, Washington, D.C.

Nov. 17-19. Building Research Institute, Fall Conferences, Shoreham Hotel, Washington, D.C.

Nov. 30-Dec. 4. 27th Exposition of Chemical Industries, New York Coliseum, New York, N.Y.

Jan. 12-15, 1960. 16th Annual Technical Conference, Society of Plastics Engineers, Conrad Hilton Hotel, Chicago, Ill.

Jan. 26-27, 1960. Society of Vacuum Coaters, Technical Conference, New York, N.Y.

New Research Center

The American-Marietta Co., Seattle, Wash., dedicated its new research center located on Harbor Island, Seattle, on June 19. Among those participating in the ceremonies included The Reverend Cyrus E. Albertson, First Methodist Church, Seattle; Donald V. Redfern, vice-president, American-Marietta; The Honorable Albert D. Rosellini, governor of Washington; and The Honorable Gordon S. Clinton, mayor of Seattle. Principal dedicatory speaker was Prof. Houlder Hudgins, nationally known authority on industrial automation from the Massachusetts Institute of Technology.

The dedication was followed by an industrial symposium on "Vertical versus Horizontal Integration" or research's part in supporting horizontal integration. Speakers at the symposium were Dr. O. Harry Schrader, (U.S. Plywood); William J. Zellerbach (Crown Zellerbach); Clark C. Heritage (consulting engineer); and Robert E. Pflaumer (American-Marietta).

The new research facilities consist of 21 unit laboratories and six process development areas; and equipment for the testing and evaluation of forest products. According to the company, programs will be conducted in basic and applied research, product development, process and equipment development and analytical research. Research will be directed into fields of plywood, composition boards, wet strength and special papers, corrugated containers, pulp moldings, mineral wool, foundry cores and shell molds, the company states.

Laminators Join SPI

The Vinyl-Metal Laminators Institute has joined forces with The Society of the Plastics Industry, Inc. The Institute, which has been in existence for two years and consists of seven companies which laminate vinyl film and sheeting to metal, will function as a division of SPI. According to report, the Vinyl-Metal Laminators Institute has prepared specifications for vinyl-metal laminates produced by its members and is working on additional specifications. Consideration is also being given to commercial standards as promulgated under the standards procedures of the United States Department of Commerce.

3M Elections Announced

Minnesota Mining and Manufacturing Co., St. Paul, Minn., has announced that Dr. C. W. Walton has been elected vice-president of the Adhesives, Coatings and Sealers Division, while C. C. Smith has been named vice-president of the Retail Trades Tape Division. Other division vice-presidents elected include H. H. Heltzer, Reflective Products; R. H. Herzog, Duplicating Products; R. V. Holton, Electrical Products; and Dr. W. W. Wetzel, Magnetic Products. The company has also announced that L. B. Gehrke has been elected assistant treasurer.

Dr. Walton joined 3M in 1947 after 13 years' service with the Goodyear Tire and Rubber Co. He was named general manager of the New Products Division in 1948 and general manager of the Adhesives, Coatings and Sealers Division in 1952. Mr. Smith, a 30 year 3M veteran, joined the firm's sales office in 1928. He was named eastern sales manager in 1936; national sales manager for cellophane tape in 1941; general manager of the Tape Division in 1949; and general manager of the Retail Trades Tape Division in 1952.

Mr. Heltzer joined 3M in 1933 and has served the firm in several capacities. He was named general manager of the Reflective Products Division in 1952. Mr. Herzog joined the company in 1941 and has been general manager of the Duplicating Products Division since 1956. Serving as general manager of the Electrical Products Division since 1955, Mr. Holton has been associated with the firm since 1943. Dr. Wetzel, who pioneered the development of magnetic recording tape, joined the firm in 1944 and has been general manager of the Magnetic Products Division since 1955. Mr. Gehrke joined 3M in 1949 and during the last two years has served as staff assistant to the 3M treasurer.

O'Neill Joins Staley

A. E. Staley Manufacturing Co., Decatur, Ill., has appointed Andrew B. O'Neill as a sales representative in the East to serve the paper, corrugated, building materials and related industries. A native of New Jersey, Mr. O'Neill has been associated with the paper industry since he was graduated from New Jersey State Teachers College in 1951.

Armour Names Patton

Armour and Co., Chicago, Ill., has named F. B. Patton as senior vice-president. Mr. Patton will assist E. W. Wilson, executive vice-president, in the administration of the divisions of Armour Chemical Industries. Mr. Patton has been a vice-president of Armour since 1955, and he formerly was in charge of the Armour Auxiliaries Division. The company also announced that the Armour Auxiliaries Division designation, which covered a group of the company's non-food products, will be discontinued. Armour Alliance Industries, a new grouping, will handle production and sale of adhesives, coated abrasives and cushioning products, with headquarters in Alliance, Ohio.

National Starch Expands

National Starch Products Co., New York, N. Y., has expanded its granite board facilities in Goffstown, N. H. Manager of the Structural Products Division, A. C. Battaglia, stated that the expansion will permit better deliveries and service to customers in the furniture and allied industries.

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Building Industry Forum

Approximately 600 architects and builders attended the National Building Industry Forum, sponsored by Thiokol Chemical Corp., which was held at the Ambassador Hotel, Los Angeles, Calif., on May 20. A panel was conducted in which seven California and West Coast architects and building materials experts discussed how proper use of new materials, such as sealants based on polysulfide rubber, can be utilized to permanently seal and weatherproof modern non-residential buildings. The discussion emphasized curtain wall types with their large expanses of metal and glass.

The forum was moderated by Arthur B. Gallion (University of Southern California); Speakers included Herman Charles Light (architectural consultant); Robert P. Darlington (Washington State University); Lowell Carstensen (Kawneer); and E. R. Williams (Williams Waterproofing). Panel members were F. A. Loebach (Kaiser Aluminum); Ralph Lane (W. P. Fuller); and J. R. Panek (Thiokol Chemical).

Reichhold in Venezuela

Reichhold Chemicals, Inc., White Plains, N.Y., has announced the formation of a new company to produce synthetic resins in Caracas, Venezuela. The new firm, named Resinas Venezolanas C.A., was formed with a group of prominent Venezuelan industrialists and will manufacture its products under formulas and techniques developed by RCI, the company states. Reichhold also announced that the manager of the new company will be Dr. Ricardo Pines, who has gained extensive knowledge of the production and application of resins in RCI plants and laboratories. Principal consumers of the resins will be the adhesives, surface coating, polyester and plastics industries of Venezuela, the company reports.

Dow Buys Factory

Dow Chemical Co., Midland, Mich. has purchased a vacant factory building in Findlay, Ohio, and plans to convert it to the production of polyethylene film. The plant contains 208,000 square feet on a 27 acre tract. The company also announced that its Dobeckmun Co. division will share production planning and engineering duties at the factory.

Animal Glue Shipments

The United States Census Bureau has reported that shipments of animal glue were higher in April than in March and in April, 1958. The bureau set April shipments at 10,707,000 pounds, compared with 9,644,000 in March and 7,908,000 in April, 1958. April production was 9,798,000 pounds or 1,199,000 higher than a month earlier, but 395,000 less than a year earlier.

Stocks on April 30 were reported at 33,716, lower than either of the two comparative months. In a second report, the Bureau said that April shipments of gelatin, set at 4,904,000 pounds, were below the March figure of 5,432,000 and that for April, 1958, of 4,993. April production of gelatin, which totaled 4,768,000 pounds, was down 469,000 pounds from a month earlier but up 221,000 from a year earlier. April 30 stocks were 13,040,000 pounds, lower than the two comparative months.

Grace Signs Agreement

W. R. Grace & Co., New York N. Y., and Reichhold Chemicals Inc., White Plains, N. Y., have signed an agreement whereby Grace will use Reichhold's "techniques and formulas" at the Probst y Cia. plant, Medellin, Colombia, a Grace subsidiary. That firm produces detergents, insecticides, textile and agricultural chemicals and some resins. Probst now uses know-how from Dewey and Almy for its polyvinyl chloride operation and the new agreement will provide other resins for local manufacturers of surface coatings and plywood adhesives.

Buys Mexican Plant

National Starch & Chemical Corp. has announced the purchase of Polimeros S. A., a manufacturer of vinyl acetate polymers, located in Mexico City. According to Donald Pascal, president of National Starch, the company has been interested in the possibilities of Polimeros since its founding in 1954. National Starch assisted in the design of the original plant and equipment and had licensed Polimeros to manufacture polymers in Mexico. Donald E. Reese, founder of Polimeros, will continue as its president, and the company will operate as a wholly-owned National Starch subsidiary. Production from the Mexican plant has been used primarily by the paint industry for the manufacture of latex paints. The company reports that additional equipment will be installed so that a complete line of vinyl acetate polymers and copolymers, as well as adhesives for the packaging, structural, and furniture industries may be made.

Adhesive Tape Plant

Adhesive Tape Corp., Brooklyn, N.Y., has acquired a new modern pressure-sensitive adhesive tape manufacturing plant which is fully equipped with the latest processing machinery. The plant is located at 58 Seabring Street, Brooklyn, and was constructed at an original cost of more than $500,000. According to the company, the plant features the latest in industrial electronic quality control instruments such as Tracerlab's Beta Gauges, designed specifically to insure a uniform quality control. Floyd R. Warner, vice-president, will supervise the national sales of a complete line of quality pressure-sensitive adhesive products under the brand name of Adheco. This line includes pressure-sensitive adhesive tapes, liner tapes, and rolls and sheets on paper, cloth, film and foil.

Horn Opens New Plant

A. C. Horn Co., a division of Sun Chemical Corp., Harrison, N.J., has opened a new plant at North Bergen, N.J., for production of building materials and maintenance supplies. Horn reports that the materials produced will include caulking compounds, water repellents, masonry damp-proofing coatings, concrete hardening agents, and expansion joint compounds.

Fuller Managers Meet

H. B. Fuller Co., St. Paul, Minn., has announced that top executives from company plants in the United States and Canada met recently at Treadway Inn, Niagara Falls, N. Y., for the company's quarterly managers conference. Host manager was G. A. McDougall, vice-president of H. B. Fuller Co., Buffalo, N. Y. The conference began on Wednesday morning, June 24, with an address on "Research and Development," by R. E. Smith, vice-president for research in Fuller's St. Paul unit.

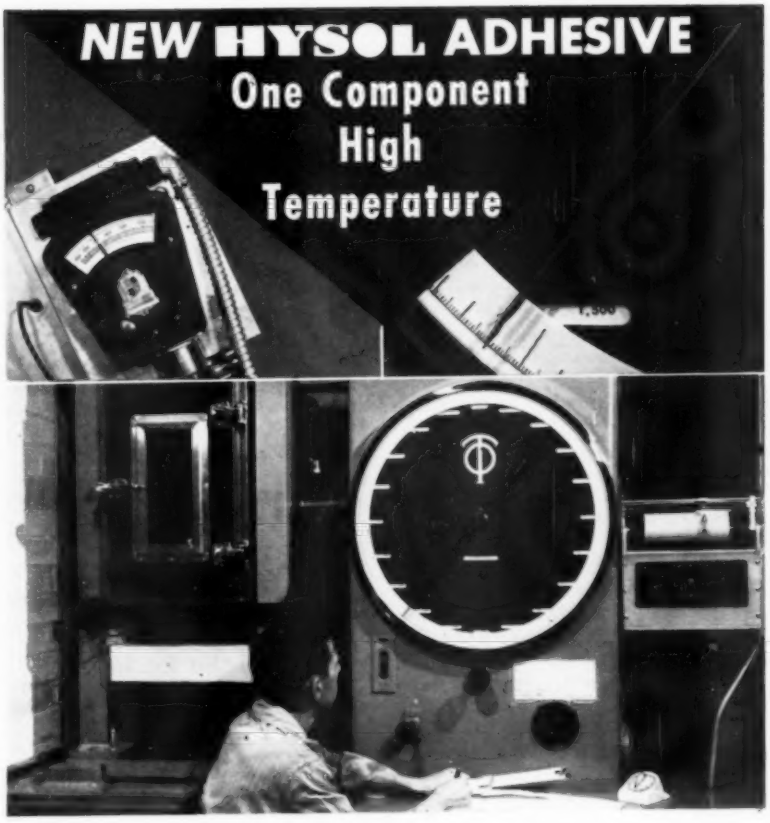
Speaker at the Wednesday noon luncheon was William G. Shepherd, program director of the American Management Association in New York City. R. E. Foley, executive vice-president at Fuller's St. Paul offices, spoke on "Production and Marketing." The Thursday-Friday schedule included a visit to the H. B. Fuller plant in Buffalo; the company board meeting; and a report on the company's epoxy resin adhesive, Resiweld, which was presented by D. G. Croonquist, secretary-treasurer at the St. Paul office.

Coating Resin Index

A new Surface Coating Resin Index has been prepared jointly by the Surface Coating Resin Section of the British Plastics Federation and the Surface Coating Synthetic Resin Manufacturers' Association. The booklet, which replaces a similar index published in 1955, aims at giving, under one cover, the basic information on all British-made surface coating synthetic resins at present available to the paint, printing ink and allied trades. Fifteen groups are covered and there is an index of trade names as well as producers. The index is available from the British Plastics Federation, 47-48 Piccadilly, W 1, London, England.

Vacuum Symposium

The American Vacuum Society, Boston, Mass., has announced that the 1959 Sixth National Symposium on Vacuum Technology will be held on October 7-9 at the Sheraton Hotel in Philadelphia, Penna. According to the society the symposium will offer opportunities for the communication of recent findings; the evaluation of new ideas; and an enchantment of knowledge in this field of modern science.



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New Dewey & Almy Plant

Dewey and Almy Chemical Division of W.R. Grace & Co., Cambridge, Mass., has announced the opening of its new plant at Owensboro, Ky., which will manufacture battery separators, polyvinyl acetate polymers and copolymers, and butadiene styrene synthetic rubber latices. According to the company, the $4 million facility doubles the company's total capacity to produce polyvinyl acetate emulsions and butadiene styrene latex. Total latex and vinyl emulsion capacity at Owensboro is 20,000,000 pounds a year, the company states, and the plant increases by 30 per cent the firm's capacity for resin impregnated fiber separators for the storage battery industry.

The Owensboro plant, of concrete block and asbestos siding over steel, covers two acres of floor space in four major buildings: an organic chemicals reactor building; organic chemicals storage building; battery separator building; and an office laboratory and warehouse building. The Owensboro plant is operated by two of Dewey and Almy's three divisions under a single plant manager. Organic chemicals are produced by the Organic Chemicals Division, of which Thomas G. Gibian is general manager. Harry R. Marty formerly manager of process development in the Organic Chemicals Division, has been named plant manager of the new plant.

SPI Adhesive Committee

The Plastics Wall Tile Adhesive Committee of the Society of the Plastics Industry, Inc., New York, N.Y., met recently to discuss ways and means of further improving adhesives used to attach polystyrene plastic wall tile. The committee, under the chairmanship of F.L. Syracuse (Macco Chemical), agreed that adhesives generally being distributed today are highly satisfactory, although improper wall preparation may lead to failure because of oxidation of mastic due to wall porosity. It was also agreed that the plastic wall tile business this year is continuing to show a strong recovery movement and that there is a trend toward thicker tiles of improved quality. According to the committee, continued cooperation between the plastic wall tile manufacturers and the adhesive suppliers is expected to further strengthen the competitive position of plastic wall tile.

Armour Signs Agreement

Armour Chemical Division, Armour & Co., Chicago, Ill., has announced the signing of a manufacturing agreement with Chemical Developments of Canada, Ltd. Under the agreement, Chemical Development will produce at its Longford Mills, Ontario, plants, many of the chemicals Armour previously supplied Canadian industry from its plants in the United States. Armour also announced that A. M. Stuart has been named Canadian sales representative. Mr. Stuart, formerly a technical representative for Eaton Chemical & Dyestuff Co., Toronto, has had a wide background of experience in technical sales to the rubber, plastics, petroleum and chemical processing industries of Canada. He is a member of the Society of Plastics Engineers.

Polyethylene Resins

Spencer Chemical Co., Kansas City, Mo., has announced that it is now marketing an entirely new series of polyethylene resins designed specifically to meet the requirements of general film use. The new line of Poly-Eth resins, classified as the 5100 series, is said to contain an excellent high clarity and gloss with unusual strength and ease of processing. Spencer expects that resins for coatings and blow molding will be added to the series in the near future.

Biggs Epoxy Plant

Carl H. Biggs Co., Santa Monica, Calif., has opened a new 12,000 square foot plant at Santa Monica. The plant will produce Helix epoxy bonding agents.

Technical Paper Awards

The Protective Coatings Division of the Chemical Institute of Canada, Ottawa, Ont., Canada, has announced the establishment of two annual cash awards for technical papers. The papers submitted for consideration by the Awards Committee must be directly related to the protective coatings industry. The awards consist of a $100 first prize and a $25 second prize, and will be offered, for the first time, for papers submitted by February 1, 1960. Among the conditions for the award are that the papers shall be of such caliber that they will reflect a step forward in a real scientific contribution to the coatings industry.

The paper must be a concise and informative discussion of approximately 3000-6000 words, although the length mentioned is a guide and will not be held as a binding requirement. Papers must be accompanied by a 200-300 word abstract. The competition is open to members of the Chemical Institute of Canada and to all undergraduate and graduate students of a Canadian university. According to the institute, the papers will be rated on originality, scientific importance, practical value to the paint, varnish or lacquer industries, completeness of discussion, significance of deductions, and quality of composition.

Completes Resins Plant

Union Carbide Plastics Co., New York, N.Y., a division of Union Carbide Corp., has announced that its new liquid epoxy resins plant at Marietta, Ohio, has gone on stream. According to the company, the plant has a rated capacity of 15 million pounds annually and will produce epoxies for such end uses as adhesives, protective coatings, reinforced plastics, laminating materials, production tools and dies, and encapsulation and potting of electronic components.

Opens Sales Offices

The Chemical Division of General Mills, Minneapolis, Minn., has opened a new sales office at 20800 Center Ridge Road, Cleveland, Ohio. The Cleveland sales office is the ninth opened by the division in the past two years. It will serve such major industries as adhesives, coatings, soaps and detergents, plastics, mining, pharmaceuticals, petroleum and textiles.

Packaging Adhesives

W. H. Bromley, director of marketing, Shawinigan Resins Corp., estimated that the use of synthetic resin adhesives in packaging this year will hit close to 165 million pounds and be valued at approximately $40 million. He made these disclosures in a report to the 28th National Packaging Exposition held April 13-17 in Chicago, Ill. Mr. Bromley said that by the end of this year the volume of synthetic resin adhesives used for packaging purposes will have grown more than 200 per cent since 1950 when only 53 million pounds were employed. Of the 165 million pounds expected to be consumed this year, more than 70 per cent will be based on polyvinyl acetate, he said.

The increase in the use of synthetic resin adhesives is due to the development of new resins for specific, unique end-uses and to the development of high speed application equipment, he stated. According to Mr. Bromley, hot melt adhesives are just now being rediscovered. Based on polyvinyl acetate, he continued, such adhesives have been found excellent for bonding non-porous materials such as foil, waxed paper and polyethylene. He remarked that current research efforts by raw material suppliers, adhesive manufacturers and package producers are being directed toward the development of wider applications for synthetic resin adhesives.

Sales and Earnings Up

National Starch & Chemical Corp., New York, N.Y., formerly National Starch Products, Inc., has announced a 16.4 per cent increase in sales and a 18.7 per cent increase in earnings for the first quarter of 1959 over the same period last year. Net sales for the first quarter of 1959 totaled $12,374,035, compared with $10,632,243 for the like period of 1958. Net earnings for the quarter ended March 31 amounted to $692,315, equal to 69¢ a share after providing for preferred dividends, compared with earnings of $583,048, equal to 59¢ a share after preferred payments for the same period last year. The company reports that the improvement reflected an over-all increase in volume, and was due only to a minor extent to the inclusion of Granite Board which previously had not been consolidated.

Furniture Conference

Cellular Plastics Division of the Society of the Plastics Industry, Inc., New York, N.Y., sponsored a Furniture Conference on May 25 at Greensboro, N. C. The program included discussions of flexible vinyl foam in furniture; flexible urethane foam in furniture; new concepts in furniture design; a panel discussion on the future of all types of cellular plastics for furniture applications; and a discussion of business conditions in the cellular plastics industry. A spokesman for the division said that this was the first time the group had geared a conference to a specific industry and that the conference was considered timely because of the increasing use of cellular plastics.

BRRAMA Elects Officers

British Rubber and Resin Adhesive Manufacturers' Association has reelected its officers for 1959-1960, at its general meeting in Shawbury, England, on May 5. The following officers were reelected: *Chairman*, D. E. Cameron (B.B. Chemical Co., Ltd.), and *Vice Chairman*, N. G. Bassett Smith (Dunlop Rubber Co., Ltd.)

ADHAESION

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patent review

By MELVIN NORD

Glue Machine Rolls

U. S. Patent 2,876,734, issued March 10, 1959 to Charles D. Nitchie, assigned to Samuel M. Langston Co., relates to glue machines used in the production of double faced corrugated board for applying glue to the tips of the flutes prior to application of the second facing liner. The object is to provide means whereby a constant pressure may be exerted on the web by the rider roll irrespective of variations in the thickness of the web.

In the schematic diagram the numeral 1 indicates the conventional applicator roll of a glue machine, and the numeral 2 indicates the doctor or metering roll which is associated with the applicator roll. The numeral 3 indicates the rider or pressure roll. These three rolls and their relative arrangements are in general conventional, as also is their relation to the paper web to which the adhesive is to be applied. This web, indicated by the reference numeral 4, travels between and in contact with the rolls 1 and 3 as illustrated.

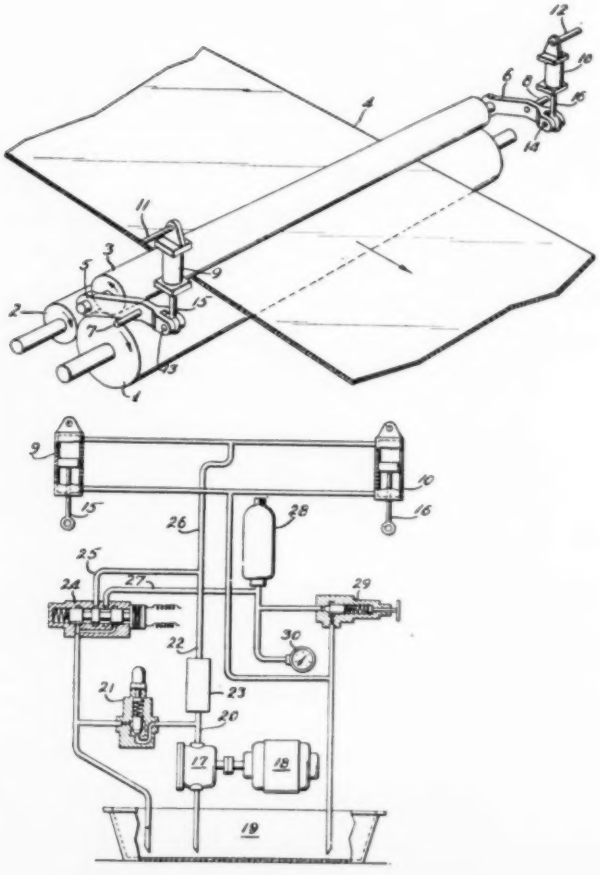
In accordance with the present invention, the roll 3 is journalled in arms (5 and 6) at opposite ends of the roll. These arms are pivotally mounted on pins (7 and 8) in the fixed frame (not shown) of the machine. Hydraulic cylinders (9 and 10) are also pivotally mounted, by way of trunnion pins (11 and 12) in the frame, and clevis pins (13 and 14) connect the piston rods (15 and 16) of the hydraulic cylinders to the ends of the arms (5 and 6).

Referring to the hydraulic circuit, illustrated in the lower part of the schematic, a pump (17) driven by a motor (18) draws oil from a reservoir (19) and supplies it under pressure to a pipeline (20). A relief valve (21) protects the system from excessive pressure. A metered quantity of oil is supplied to line 22 through a pressure compensated orifice (23) which responds to variations in system pressure to maintain a substantially constant volume delivery of the hydraulic medium to the system from the pump. A solenoid valve (24), when de-energized, as illustrated, closes pipe line 25 so that oil flows through line 26 under full pressure to the head end of cylinders 9 and 10, thereby extending the piston rods 15 and 16, rocking the arms 5 and 6 clockwise (as viewed in the top part of the diagram) on their respective pivot pins (7 and 8), and elevating the pressure roll (3) out of engagement with the web (4).

When the machine starts the solenoid valve (24) is energized, so that line 25 is connected to line 27 and accumulator 28, manually adjustable pressure relief valve 29 and gauge 30. Under these conditions, the pressure in line 26 and cylinders 9 and 10 is reduced to the setting of the relief valve (29), which may be adjusted to apply pressure through the cylinders (9 and 10) to the arms (5 and 6) so as to counter-balance part of the weight of the roll (3) and to allow it to contact the paper with desired regulated pressure.

Variations in the thickness of the web and the resultant variations in the system pressure will be compensated by the cushioning action of the accumulator (28), the accumulator also affording the degree of resilience in the system which is necessary to permit the minor adjustments of the roll (3) required for maintenance of a constant pressure relation with the variable web. Increased thickness in the web tends to reduce system pressure, and decreased thickness tends to increase system pressure. The variations are small and the compensation is immediate.

As long as the machine remains in operation, the resultant energization of the solenoid valve (24) will maintain the system in operative condition with respect to the pressure function of the roll (3) with the



accumulator and the valve (29) connected in the system with the cylinders (9 and 10). If the operation of the machine is interrupted, the valve (24) will be de-energized and will move automatically into the position shown in the drawings. The valve (29) and the accumulator will then be disconnected from the pump (17) and full pump pressure will then be applied to the head ends of the cylinders (9 and 10) to elevate the roll (3) from the web.

Adhesive Compositions

U. S. Patent 2,875,081, issued February 24, 1959 to George D. Duro, assigned to the Harshaw Chemical Co., relates to improvements in methods for preparing adhesive composition from aluminum soaps and waxes.

According to the invention, it has been found that a gel of microcrystalline wax and aluminum soap may be produced readily by producing the aluminum soap in situ through a reaction involving an aluminum trialcoholate derived from an alcohol having 2-5 carbon atoms, a saturated higher fatty acid, and water, provided certain conditions are adhered to during the preparation of the aluminum soap.

Release Agents

U. S. Patent 2,876,895, issued March 10, 1959 to William S. Port and Edmund F. Jordan, assigned to Secretary of Agriculture, provides release agents for pressure-sensitive adhesives.

The release agents are copolymers of vinyl esters of long chain fatty acids (e.g., vinyl stearate) with vinyl chloride or maleic anhydride.

Pressure-Sensitive Tapes

U. S. Patent 2,878,142, issued March 17, 1959 to Gene Bohaty, assigned to Mystik Adhesive Products, Inc., relates to the manufacture of a pressure-sensitive tape usable under widely varying atmospheric conditions for the purpose of electrical insulation.

It has been found that the desired inertness for use as an insulation material, and that the desired stability under widely varying atmospheric conditions, are available from relatively few film-forming materials. Of the large number of film-forming resins available, the desired combination of inertness, flexibility,

and stability appears to be limited to film stock formed of polyethylene and polyethylene derivatives such as polyethylene terephthalate and polytetrafluoroethylene. These resinous materials are capable of forming highly flexible, inert films which retain their flexibility and strength and inertness at temperatures as low as —60°F. and above 300°F. without deterioration of their high electrical insulating properties.

A similar problem exists with respect to the pressure-sensitive adhesive since rubber-resin systems become embrittled and lose their adhesiveness at low temperature and the cohesive strength is reduced when used at temperatures much above room temperature.

Pressure-sensitive adhesives having the desired inertness and temperature stability have been formulated of organosilicon polymers believed to be composed chiefly of methylpolysiloxane, in which the number of hydrolyzable groups in the silane are sufficient upon polymerization by condensation to form an elastomer which has adhesive properties upon cure. An organosilicon polymer capable of use in the practice of this invention as a pressure-sensitive adhesive is being marketed at the present time by Dow Corning Corp., under the tradename XC-269.

The pressure-sensitive organosilicon adhesive has been applied as the adhesive layer onto film stock formed of polyethylene, polyethylene terephthalate, and polytetrafluoroethylene, but the adhesive tape that is formed has been found to be unsatisfactory because the cohesiveness of the adhesive is greater than its adhesiveness for the resinous film, with the result that the bonding relation of the film and the pressure-sensitive organosilicon adhesive is insufficient to prevent separation.

The present invention utilizes an anchor coat between the pressure-sensitive layer and the resinous film, as shown in the accompanying diagram. The anchor coat consists of a combination of the organosilicon polymer with a butadiene-acrylonitrile copolymer. The materials combine to form a relatively stable system.

Other Patents of Interest

Subject	Inventor or Assignee	Patent No.	Date
Adhesive silicate composition	Diamond Alkali Co.	2,870,033	1/20/59
Laminating adhesive	American-Marietta Co.	2,870,034	1/20/59
Asphalt-base mastic	A. O. Smith Corp.	2,870,036	1/20/59
Machine for applying and cutting adhesive tape	Boston Machine Works Co.	2,871,493	2/3/59
Sizing paper	Hercules Powder Co.	2,872,315	2/3/59
Liquid rosin sizes containing anti-stratifying agent	American Cyanamid Co.	2,873,203	2/10/59
Method for wrapping an object with adhesive tape	Bernard E. Bogeskov	2,873,564	2/17/59
Apparatus for applying adhesive to predetermined areas of a series of articles	Food Machinery & Chemical Corp.	2,873,717	2/17/59
Protective tape applicator	Francis J. Ditter and William C. Kaercher, Jr.	2,873,789	2/17/59

Copies of any patents, including those described here, are available from the Commissioner of Patents, Washington 25, D. C., for 25 cents each. Do not send stamps.

new equipment

Spraying Machine Timer

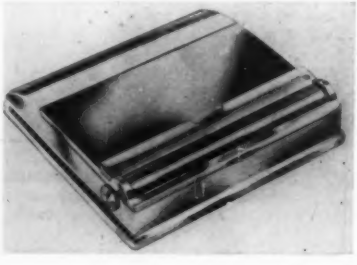
A new control mechanism, originally developed for the tanning industry, is for use on either rotary or vertical and horizontal automatic spraying machines to substantially reduce overspray and material loss. The electro mechanical timer is designed to control individual spray guns so that the spray pattern follows the outline of the material and actuates guns only when there is a surface to be sprayed. Reduction in spraying of blank areas can effect material savings of up to 45%. The control can be adapted to existing spray machines, installation being greatly simplified so that it requires only a minimum of time. The mechanical memory system is said to be unaffected by surroundings, and to be easily understood by maintenance personnel without special training. The instrument is enclosed in an individual housing which prevents entry of dust and dirt. *Binks Manufacturing Co.* **E-100**

Flow Measuring Devices

A line of purge rotameters for measuring and controlling fluids flowing at low rates features instruments of compact design making them suitable for front-of-panel mounting or for mounting directly in pipelines. The instruments are applicable to liquids and gases. Nine flow ranges are available, all obtained in the same basic body through the use of interchangeable glass metering tubes and glass or stainless steel floats. The smallest capacities available over a 10 to 1 range are 0.6 gph of water or 0.50 scfh of air (metered at 10 psig). Capacities of the largest units are 12 gph of water and 70 scfh of air (metered at 10 psig). Special models of the instrument, constructed of Kel-F elastomer and lucite, are also available. *Schutte and Koerting Co.* **E-101**

Label Gluer

A new heavy duty label gluer, designed for applying glue to large-size ungummed labels, is said to be ideal for industrial users of large labels. Simplicity of construction makes it easy to operate and clean. The gluer comes in three sizes: 6 inches, 9 inches and 12 inches. *Glue-Fast Equipment Co., Inc.* **E-102**



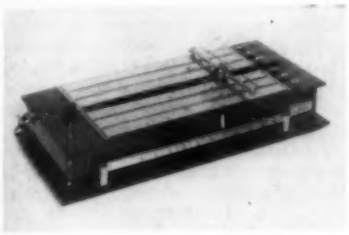
Automatic Scales

The Autogram is designed to provide an economical, rapid and accurate method of weighing and dispensing batches of one or a multiple of liquids. It is only necessary to set the scale for the desired weight, press a control switch and an electrically controlled valve dispenses the liquid and shuts off when the proper amount has been dispensed. The instrument can be used for packaging of liquid materials by weight or volume, pre-weighing batches of resins or catalysts, and in some cases as a complete resin-hardener dispenser. Any number of valves may be used with the scale. The Autogram is said to have a reproducibility of ±1% or ±0.5 grams, whichever is larger, the capacity being 210 grams (2000 grams optional). It is 14 inches wide, 7 inches deep and 10 inches high, and weighs approximately 7¾ pounds. *Delsen Corp.* **E-103**

Drying Recorder

A drying recorder device is designed to give scientifically precise measurement of drying time of any chemical product. This laboratory instrument is portable and compact enough to be used with auxilliary equipment to vary the atmospheric conditions under which drying takes place. The machine is said to determine the drying time of both quick and slow-drying materials. The re-

corder not only registers different stages of the drying process, but also provides data on other physical properties of the film, for example,



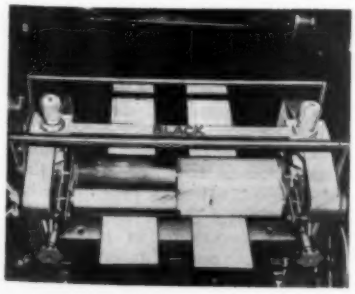
adhesion through drying and tendency to wrinkle. Strips of metal on which the materials are tested may be removed and used as a permanent record. *Eastern Precision Tool & Gage Co.* **E-104**

Protective Gloves

Disposable safety gloves, called Handgards, made of polyethylene film, come in rolls of 12, 24, 48 and 144. They are recommended for facilitating clean-up after work with epoxy adhesives, and for many other applications. The gloves are said to be watertight, sanitary, alkali and acid resistant, and to provide maximum fingertip sensitivity. *Carl H. Biggs Co., Inc.* **E-105**

Roll Glue Spreaders

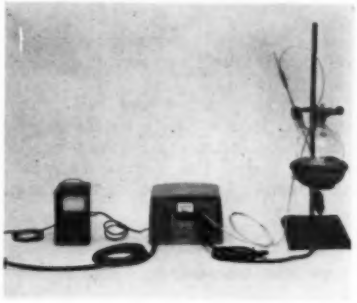
The accompanying illustration shows one of a line of resilient roll glue spreaders, this particular model being designed for single and double coating simultaneously. This unit has proven useful in gluing laminated stock of uniform thickness when the top and bottom pieces are single coated only, and the inside sandwiched laminae are double coated. The spreaders have an adjustment of 0 to 4½ inches. A wide variety of stock from thin boards to 2 x 8's and larger dimensions can be glued. Optional extras include variable speed



drive, circulating pump unit, and water cooled doctor rolls. The spreader can be used for liquid resins, casein and similar adhesives, and is said to be capable of carrying out large production programs speedily and efficiently. *Black Bros. Co., Inc.* **E-106**

Temperature Control System

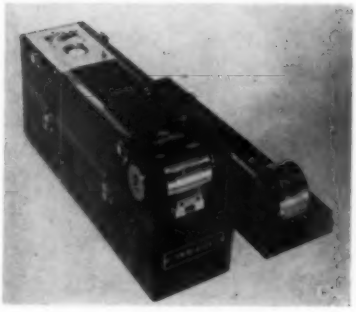
A new, economical, transistorized automatic control system for fluid (gas and liquid) processes is said to provide continuous, automatic, precision temperature control in both liquid and air baths to a tolerance of ±0.1°C. It is designed to permit completely unattended operation



without interruption for days if necessary, and to eliminate the need for personal attention in controlling temperature. The system can be applied in any situation where a mercury thermometer can be used as the primary sensing agent. The effective temperature range is −38 to +340°C. The system can be coupled with a strip recorder to provide a continuous temperature history record. It consists basically of a transistorized crystal controlled oscillator circuit which is stabilized against supply voltage variation and ambient temperature changes. *Milltown Instrument Co.* **E-107**

Standard Force Gage

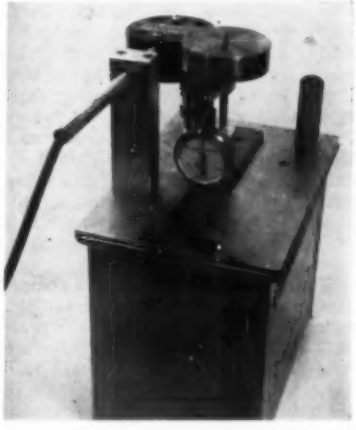
The availability of a line of compact and relatively inexpensive precision force gages is simplifying the design of a number of specialized force measuring instruments, like the illustrated Thwing-Albert T-A-C tester designed to test adhesive bond strength. The gage used in this tester is one of a line of 18 which have maximum capacities ranging from 500 gm. to 200 pounds. They come either with or without a hold-maximum indicator hand, and are claimed to be accurate to at least



±½ per cent of full scale. They are capable of being hand held, and are easily adaptable to special test setups. The tester illustrated can check adhesives used to join paper, foil, textiles and paperboard to each other and to other materials in laboratory size samples. It is useful in eliminating extensive trial-and-error adhesives adjustments on production machinery. *Hunter Spring Co.* **E-108**

Distortion Tester

A distortion tester indicates the deflection of thermoplastics subject to various loads and temperatures in



accordance with ASTM Designation D-648-56. Deflection is noted on a dial indicator mounted on the specimen holder. The apparatus consists of the bath, heater, agitator, specimen holder and test bar. *Custom Scientific Instruments, Inc.* **E-109**

FOR MORE INFORMATION on the new equipment items described here, use the Reader's Service Card elsewhere in this issue.

book reviews

Plastics and Adhesives: A Guide to Their Physical Properties and Uses. ***By Lawrence R. Dallett and William E. Donaldson. Published by Office of Technical Services, United States Department of Commerce, Washington 25, D. C. 8 x 10½ in. 108 pp. $2.50.***

This paperbound brochure is a reprint of an original document, prepared in 1956, resulting from government-sponsored research. It is now being offered to the public by the Office of Technical Services through the cooperation of the originating government agency.

Divided into two parts on plastics and adhesives, the book is designed to provide a concise and basic but complete guide to materials which fall within these categories. The section on adhesives has chapters on: Theory of Adhesion; Factors Involved in Choice of Adhesives (Bond Strength, Environment, Nature of Adherends, Type of Load Concerned); Kinds of Adhesive (Vegetable Glues and Natural Gums, Thermoplastic Resin, Thermosetting Resins, Phenolic, Urea Formaldehyde, Melamine Formaldehyde, Resorcinol, Epoxy Resin, and Thermosetting, Protein and Rubber).

A bibliography of 23 references closes the section. This is followed by extensive appendices, one containing data on physical and performance properties in tabular form, the other lists of miltary and government specifications.

The authors have prepared a competent summation of the adhesives field, going both into theory and the practical aspects of their subject. The person who wants basic knowledge will read their work with profit. The Office of Technical Services is to be commended for making it available.

Automatic Process Control. ***By Donald P. Eckman. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. 6 x 9¼ in. 368 pp. $9.00.***

Written for engineers who are concerned with instrumentation, this book treats the important principles of automatic control, emphasizing block diagrams and frequency techniques in process control. It begins with process analysis and carries on into the generalized behavior of closed-loop systems. Systems problems are given a great deal of study.

The techniques of analysis are used fully, and enough detail is carefully presented so that some of the more difficult problems in automatic process control may be inspected rather closely. The author incorporates numerous problems with answers and nine detailed experiments, including one involving the analog computer.

Special topics covered include new electronic controllers, control elements and actuators, non-linear elements often encountered in process control, Nyquist and Bode diagrams, fluid and thermal process control, computer optimizing control and direct comparison of control actions.

This is an advanced book, not for the beginner. It is a timely publication in this era of increasing automation. As we all know, this science forecasts vital changes in the plant of tomorrow.

Work Measurement. ***By Virgil H. Rotroff. Published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. 5 x 7½ in. 204 pp. $4.85.***

The purpose of this book is to present the fundamental principles and techniques of work measurement and their practical application to industrial problems today. The methods and procedures described in this book were developed and refined from the first-hand experience of management consultants, industrial engineers and others actively engaged in the field of work measurement.

Essential information on all phases of a work evaluation program is presented—why work is measured; what work measurement means to company personnel; the standard data approach; economics of work measurement; the consultant's role; work standards "don'ts;" and labor relations and work measurement.

What the author has to say is thought provoking. It cannot be denied that today the trend is toward a scientific approach toward such problems as performance of the workman. The increasing complexity and size of industrial operations have necessitated this revision of attitude in the management of such problems. At the same time there has been an increasing awareness that such an approach often fails to consider intangible factors which affect the results predicated. To have summarized succintly current thinking on this subject is indeed a worthwhile aid for those in management associated with the work problem.

Trade Literature

Commercial Adhesives. The Ray-Bond line of adhesives; protective coatings and sealers; and casting, encapsulating and potting compounds is described in a 16-page bulletin. Sections present detailed technical data on selection of adhesives; the bonding technique; protective coatings and sealers; casting, encapsulating and potting compounds, and typical adhesive applications. Included unbound is a large chart which shows the characteristics of the principal adhesives manufactured by the company. *Raybestos-Manhattan, Inc.* **L-108**

Industrial Equipment. A 12-page brochure devoted to manufacturing equipment emphasizes that an efficient finishing system must be more than a series of units placed end to end, that is, it must be a carefully planned totality. Using many photographic illustrations, the booklet describes installations in operation in various industries and kinds of industrial plants. Information on improving existing or building new installations involving drying, baking and other operations is included. *Industrial Equipment Division, R. C. Mahon Co.* **L-109**

Bonding Concrete. The application of a liquid polymer epoxy resin adhesive for the bonding of concrete is described in an 8-page bulletin. A liquid polymer is a synthetic rubber in liquid form which cures at room temperature when an accelerator is added. Data on compression shear strength, flexural strength and tensile strength of the bonds are provided, and discussion included on the adhering of old concrete-to-old and new concrete-to-old. Use of the adhesives as an anti-skid surfacing is also discussed. *Thiokol Chemical Corp.* **L-110**

Pressure-Sensitive Labels. A new 8-page catalog covers a full line of made-to-order pressure-sensitive labels. Heavily illustrated to portray the wide variety of labels available in any shape, size or color, on paper, metal, foil, film and film laminates, the catalog also describes their uses in business and industry. Also presented in the brochure is a complete line of labeling equipment, including manual and automatic dispensers and a new label imprinter. *Avery Label Corp.* **L-111**

Adhesive Dispersions. A technical data bulletin is devoted to dispersions for solvent-cut rubber adhesives. Six of the dispersions are discussed, and advantages obtained by incorporating them are described. The last page of the bulletin contains a list of literature references. Improvements in product and economy of processing are stressed. *Kenrich Corp.* **L-112**

Trade Literature (Cont'd.)

Automatic Spray Machines. A line of automatic spray machines, suitable for applying adhesives as well as other materials, is the subject of a new 12-page bulletin. The machines perform four basic types of operations: flat work on a horizontal conveyor, curved irregular work on a horizontal conveyor, flatwork on an overhead conveyor, and curved irregular work on an overhead conveyor. Construction and operation features of the machines are detailed, and extensive data on capacities and related subjects are presented. Optional equipment includes a manual spray gun control, sheet metal enclosure, magentic brake assembly and supply hose. *DeVilbiss Co.* L-113

Polyvinyl Acetate Powder. A 6-page technical bulletin on a redispersible polyvinyl acetate powder, designated Vinac RP-250, recommends applications including joint cements for dry wall construction; spackling compounds; cement and cinder block fillers. When added to dry concrete readymixes, it will improve the adhesion of patches to old cementitious surfaces. The bulletin gives extensive data on physical specifications, and on physical tests of the end products into which it is incorporated. *Colton Chemical Co.* L-114

Bag Adhesives. A 10-page booklet on adhesives for bag manufacturers has sections on band labeling pastes, bottom pastes (resins, dextrine and starch), and seam pastes. In each of these sections various adhesives, designated by code, are listed with a short paragraph providing information (method of application, physical properties or similar data) on each. A logically laid out and useful publication. *H. B. Fuller Co.* L-115

Potting Compounds. A technical data sheet describes the uses and advantages of an expanded line of expoxy resin potting compounds. Information on physical properties and related subjects for five of the compounds is presented. Originally developed for exacting gyroscopic applications, the line now makes possible the encapsulation of metallic components with a rigid dimensionally stable material which is resistant to thermal shock. *Bacon Industries, Inc.* L-116

FOR MORE INFORMATION on the trade literature reviewed here, use the Reader's Service Card elsewhere in this issue.

Polystyrene Bonding. The properties of three adhesives, one for bonding foamed-in-place polystyrene and the other two for bonding pre-foamed polystyrene to base materials are detailed in a technical bulletin. The latter two differ in that one is water-dispersed, which means that there is no fire hazard present and that the possibility of stress-crazing is minimized. An extensive description of each is given, along with notes on uses and application procedures. A complete technical presentation. *B. F. Goodrich Industrial Products Co.* L-117

Infrared Lamps. An 8-page bulletin deals with the use of infrared lamps and their applications in industry for heating, drying and baking. Advantages, including faster heat and more efficient operation, and principles of operation are detailed. Sections are devoted to selecting the proper lamp, planning an infrared installation and determining power requirements. Among recommended uses pertinent to the adhesives industry is the drying of glue in wood assemblies. *Sylvania Electric Products, Inc.* L-118

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in passing

Average Family Income Up

According to the First National Bank of Chicago, average family income in 1958 was 50 per cent greater than it was in 1947. After adjusting for the rise in prices during the period, the increase amounts to 18 per cent. A decade ago, only 37 per cent of the families earned more than $4,000. Only one family in twenty had an income of $10,000 or more. This group, however, accounted for 20 per cent of total personal income.

One factor in the rise in family incomes has been the upward shift in occupational status of the principal wage earner. The proportion of heads of families earning their living in professional, managerial and official positions has risen from 10 per cent to 13 per cent. Clerical and sales personnel have also gained, but the percentage of blue collar workers and laborers has declined moderately. The proportion of family heads who earn their living as self-employed proprietors or professionals has declined sharply, reflecting mainly the decrease in the number of farmers.

A second factor accounting for the rise in family incomes has been the striking rise in the number of wage earners in each family. In 1949, about 21.5 per cent of wives were working; by 1957, this had risen to 28.1 per cent. This is a significant departure from the past, as in 1940 only 15 per cent of the wives were employed and in 1890 less than 5 per cent. The financial contribution of the employed wife is significant for in families in the top fifth income group, over 40 per cent of the wives are employed outside the home.

Colored Facing Tiles

Structural clay facing tiles are now being produced in nine accent colors developed by Faber Birren, color authority and consultant to the Facing Tile Institute. The nine accent colors —orange, yellow, light green, dark green, light blue, dark blue, red, brown and black—were designed to augment the color variations already available in tiles manufactured by member companies of the Institute. The colored tiles were developed as part of an Institute program of color standards set up several years ago. The standards were established to help in determining functional and esthetic applications of the tiles in factories, schools, hospitals and office buildings.

Shifting For Yourself

Most car owners know that automatic transmission and other extras cut down on gasoline mileage, but have little idea of just how much. Recent tests by researchers of the Pure Oil Co. on one large car at 45 miles per hour on a level road indicated that with an automatic shift, power steering and air conditioning, 14.47 miles per gallon were achieved. Without these accessories, 20.30 miles a gallon were achieved—a difference of about 40 per cent.

New Use for Model Plane Cement?

The Associated Press reports that one-year old James McCaller wants to be a good boy but doesn't quite know how. His mother found he had squeezed the contents of a tube onto a toothbrush and was brushing his teeth. The hitch: The tube contained model airplane cement, not toothpaste. James was rushed to a hospital where his stomach was pumped. He is home again now, not much the worse for wear.

Recommended Reading

"Why People Buy: Motivation Research and Its Successful Application," by Louis Cheskin and published recently by Liveright, deals with the behavior of people in the market place, particularly women who do about 80 per cent of the buying. The author discusses products and sales, based on tests confirmed by sales records. Mr. Cheskin is also the author of "How to Predict What People Will Buy."

And the One About

The theme of modern family living is "togetherness." This means Pop washes the dishes before he starts building the porch furniture so that Mother can get her PTA telephoning done in time to drop Junior at the Scout meeting on her way to the textile painting class.

Other Side of the Coin

The age of "hurry up" does have side effects. "We've waited 25 years to make this trip, and we're certainly not interested in getting there in any six and a half hours," is a viewpoint firmly expressed by a vacation-bound lady in a recent *New Yorker* cartoon. Makes you think.